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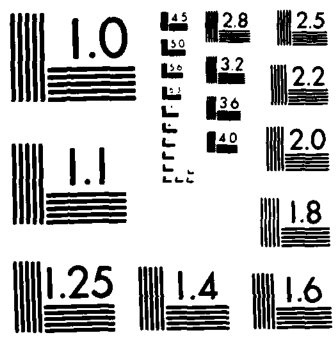

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A STUDY OF THE RELATIONSHIP BETWEEN USER ATTITUDES AND THE SUCCESS OF THE MAJCOM AND AFRCE WORK INFORMATION MANAGEMENT SYSTEM

THESIS

Kenneth W. Moschner
Squadron Leader, RAAF

Frederick W. Nightengale
Captain, USAF

AFIT/GEM/LSM/84S-15

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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THESIS

Presented to the Faculty of the School of Systems and Logistics

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Kenneth W. Moschner, B.E.
Squadron Leader, RAAF

Frederick W. Nightengale, B.S.
Captain, USAF

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<u>Table of Contents</u>

Page

Page

List of Figures

List of Tables

Page

Abstract

The Work Information Management System (WIMS) is a $95 million project to improve operational and management control at Engineering and Services organizations of the USAF. Early implementation of part of this project at installations in the U.S. and Europe provided the opportunity to study its implementation success.

This study is concerned with the factors that promote and jeopardize the success of WIMS. It determines the relationship between user attitudes and WIMS success, and explores how user attitudes and success are affected by the user's location, age, education, and prior computer experience. Using a mailed questionnaire to collect data from 400 respondents in the implementing organizations, and using factor analysis and regression analysis to analyze the data, the researchers found several significant relationships.

Positive relationships were found to exist between WIMS success and the user's attitude about how WIMS improves his/her job performance, and between WIMS success and the user's attitude about how urgent was the need for WIMS perceived. Education of users was found to positively affect one's attitude about sense of urgency but to negatively affect WIMS success and one's attitude about job performance. Age of users was found to negatively affect

WIMS success and one's attitudes about job performance and sense of urgency. Persons with prior computer experience were found to report higher levels of success with WIMS and demonstrated more positive attitudes. Finally, of the 19 locations studied, only one, Space Command, reflected a higher level of success, and only one, Tactical Air Command, displayed better attitudes about how WIMS affects job performance.

The significance of these findings reflects the importance for implementation efforts to foster positive attitudes about how WIMS can improve individual job performance and about how urgent it is for WIMS to be implemented. Moreover, implementation strategies should acknowledge the effects of how attitudes and WIMS success are affected by location, age, education, and prior computer experience of users.

A STUDY OF THE RELATIONSHIP BETWEEN USER ATTITUDES AND THE SUCCESS OF THE MAJCOM AND AFRCE WORK INFORMATION MANAGEMENT SYSTEM

I. Introduction

Overview

Between 1984 and 1987, the United States Air Force will implement the Work Information Management System (WIMS) world-wide throughout Engineering and Services at the Air Staff, major commands (MAJCOMs), separate operating agencies (SOAs) and bases. The main objective of WIMS is to improve individual job performance and organizational effectiveness. By leasing computers, the United States Air Force has implemented WIMS early at the major commands, separate operating agencies and the Air Staff. These systems will be replaced with purchased systems as part of the subsequent world-wide implementation which also includes the bases.

This study determined whether user attitudes relate to the success of WIMS at MAJCOMs, SOAs, and the Air Staff. It also determined what the relationship is. Furthermore, the study determined what effects the user's location (that is, MAJCOM, SOA or Air Staff), the user's age, the user's education level, and the user's previous experience with computers have on user attitudes and the success of WIMS.

Knowledge of such relationships could then be used to guide the strategies for world-wide implementation of WIMS so as to increase the potential for WIMS to be a success.

Chapter I of this thesis provides the background setting to the problem of not knowing how user attitudes, user demographic variables and success of WIMS relate. The chapter concludes with a statement of the research objective for the study and the research questions that are to be answered.

Theoretical and empirical literature on the subject of how user attitudes, demographic factors and success of a management information system relate is explored in Chapter II. Based on this material, Chapter III develops the methodology for answering the research questions of this study. Presented in Chapter IV is an analysis of the cross-sectional data collected from locations with leased WIMS systems. Finally, Chapter V contains the conclusions and recommendations for further research.

Management Planning and Control Systems in the 1980s

Man created organizations to accomplish objectives. Management, the process by which organizations accomplish these objectives, consists of setting organizational objectives, formulating plans, organizing activities, staffing the organization, directing operations and controlling operations (46:73). This process necessarily involves many management activities which Anthony (7:27;

8:2) categorized into strategic planning, management control and operational control.

The strategic planning process sets long-term organizational objectives and allocates overall resources. On a day-to-day basis, the operational control process assures "that specific tasks are effectively and efficiently carried out" (55:82). Management control bridges the gap between strategic planning and operational control by assuring "that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives" (7:27).

Any large modern organization selects, obtains, employs, uses and monitors an enormous variety and quantity of resources such as manpower, machines, materials, money and time. These resources must be skillfully managed by planning and control systems to ensure that tasks are carried out effectively and efficiently, to ensure that resources are used effectively and efficiently, and to ensure that objectives are accomplished in an effective manner.

Various planning and control systems are employed to support these management processes. Yet "far too much of the result is mediocrity, far too much is splintering of efforts, far too much is devoted to yesterday or to avoiding decision and action" (34:171). The massive cost of resources justifies the need for enhanced planning and

control systems to support strategic planning, management control and operational control.

Management Information Systems

Information forms the data-base for planning and control systems. Recent technology has provided man with the computer--a tool which can be used to effectively manage information in support of decision-making in resource management and operations.

The term "Management Information System" describes a computer-based organizational management information system that "provides information support for management activities and functions" (51:910). Basic management information systems store, access and retrieve information as desired by the user. More advanced management information systems can also monitor, manipulate, report and transmit information. Although management information systems can support decision-making and task performance in strategic planning, management control and operational control, most systems cater to operational control activities where the need for quick decision-making and real-time task performance is greatest (63:483).

At the operational control level, the function of such computer-based systems is not so much to support management with the right information, but rather to manage the information needs of the individual. Improved information management at the individual level contributes toward an

improvement in organizational effectiveness and managerial performance. This approach is the focus of the WIMS concept.

The efficiency in performing information management functions can be greatly enhanced by the use of a management information system. With the recent technological explosion in the computer-based information management industry, there has been a trend by organizations for greater use of management information systems (11:98). Such systems usually involve a significant financial investment for which organizations expect some return. Whatever the nature of the return may be--financial, productivity or otherwise--it is important that the system succeed in accomplishing the objectives for which it was designed.

The management information system has the potential to enhance organizational performance as well as the potential to impair organizational performance. On the one hand, it can contribute positively toward improving the way in which organizations plan and organize activities, select, obtain and use resources, and perform tasks. Thus, the scope for its use spans the broad spectrum of management activities. On the other hand, the management information system can suffer the same fate as other planning and control systems. Implemented improperly the computer can contribute equally negatively to the way in which organizations function, and thus constitutes a liability rather than an asset (1:147).

For example, Cheney and Dickson (15:171) report the implementation of a work measurement information system at the United States Post Office that

> was over two years late; cost over 60 million dollars (twice what was expected); required more rather than fewer people; had a higher error rate; had increased operating costs; and produced reports that were not used [6:340].

The success or failure of a management information system depends upon many variables. Failures can be attributable to factors that arise as early as during the system's feasibility study or requirements definition stage. Failures can also be attributable to technical problems in the system's specifications, design, programming or testing. Moreover, they can result from flaws in the documentation that supports the system. Finally, failures can be caused by problems encountered during implementation. Ultimately, it is the implementation that governs the "coal-face" success or failure of a management information system.

Early technology provided batch-oriented systems that typically operated remote from the user's work environment and thus involved little user exposure to these systems. Today, however, the emphasis is focused on integrating management information systems into the work environment. This trend has directly exposed users to these systems and has added a new dimension of problems that can arise during implementation.

Human resistance to a management information system forms an important consideration during implementation. Such behavior has been found to be influenced by the attitudes that users develop about the system (14:11; 58:146; 60:13,58; 61; 62; 69; 70; 71:70-78; 76; 81). It is also possible that demographic variables affect either or both a user's attitude and the success of the management information system.

Demographic factors such as the age, education level and computer experience of the user, and the locality of the system may also play an important role in the implementation of a management information system. For example, location can affect user attitudes and success particularly if local managers have different implementation strategies for their management information systems. Both age and educational background can also influence both user attitudes and the willingness of users to use a system. Finally, a user's previous experience with computers would have provided the user with some familiarity with computers and thus could affect his attitude toward use of the system.

User attitudes play an important role in the implementation of management information systems. On the one hand, if users display a positive attitude toward the system, then they are more likely to support the system and, the implementation of the system is more likely to succeed. On the other hand, if users develop a negative

attitude toward the system, they are less likely to support the system, and the implementation is less likely to succeed.

If managers are aware of these attitudes and other factors and understand how they relate to the relative success of the management information system, then they will be in a better position to design successful implementation strategies. In turn, this will reduce the likelihood of failure of the system due to human resistance during implementation. If managers are aware of the attitudes of users toward the system, the implementation strategies are more likely to foster positive user attitudes toward the system and are more likely to yield a successful management information system. Moreover, if managers are also aware of how demographic variables affect user attitudes and the success of a management information system, then implementation strategies can be further refined to the particular needs of the individual and the organization.

Mission of Engineering and Services

The Engineering and Services component of the Air Force consists of the civil engineering organizations, and the billeting and food service organizations of the Air Force. Its mission "is to provide the necessary assets and skilled personnel to prepare and sustain global installations as stationary platforms for the projection of

aerospace power in peace and war" (47:1). It also provides food, housing, billeting, and laundry services.

Organization of Engineering and Services

Engineering and Services is organized to perform the following activities (25:2-3; 31:2-3):

1. Management of Air Force real estate.
2. Planning and programming for the construction, maintenance and repair of real property facilities.
3. Construction management of Air Force projects.
4. Traffic planning and road design.
5. Provision and management of utility services.
6. Maintenance, repair and minor alteration of structures and equipment.
7. Planning, scheduling and performing custodial services, snow removal, refuse collection and disposal, entomology and other services.
8. Provide fire protection and prevention services.
9. Provision and maintenance of family housing, and transient and unaccompanied housing.
10. Maintain training level of personnel to support deployments, contingency and war-time operations.
11. Conserve natural resources through efficient land and forestry management and environmental pollution control abatement.
12. Provision of food services and dining facilities.
13. Management of laundry and dry-cleaning operations.

To perform these activities within the normal chain of command, Engineering and Services organizations are established at Headquarters Air Force, major commands and separate operating agencies (SOA). At bases, the function

of Engineering and Services is divided into two separate organizations. The Base Civil Engineer manages the civil engineering function while the Chief of Services manages the services function.

Headquarters Air Force. At Headquarters Air Force, the Engineering and Services function is organized into seven divisions under the Director of Engineering and Services. These divisions are Engineering, Programs, Environmental, Plans, Housing and Services, Real Property and Construction.

Major Commands. Engineering and Services at the major command level is organized under the Deputy Chief of Staff, Engineering and Services. Typically, it comprises four directorates (23:1-3; 26:33-34):

1. The Directorate of Programs which manages the facility programs and real property matters.

2. The Directorate of Engineering and Construction which manages the design and construction of new and altered facilities.

3. The Directorate of Operations and Maintenance which is responsible for facility maintenance, utility operation, maintenance management, industrial engineering and fire protection.

4. The Directorate of Housing and Services which manages all housing and services functions.

Air Force Regional Civil Engineers. Five regional separate operating agencies are established as field extensions of the Director of Engineering and Services of Headquarters Air Force. These agencies, called Air Force Regional Civil Engineers (AFRCE), primarily "assist in

managing the design and contract award phases of the Air Force construction program" (32:1). They are located at Atlanta GA, Dallas TX, San Francisco CA, Norton AFB CA, and Ruislip AFB United Kingdom.

Air Force Engineering and Services Center. Another separate operating agency is the Air Force Engineering and Services Center located at Tyndall AFB FL. It provides "technical guidance and assistance to major commands and bases in readiness and contingency operations, facility energy, civil engineering (CE) research and development, operations and maintenance, fire protection, environmental planning, billeting, and food service" (27:1).

Other Agencies. Engineering and Services also has established staff at Headquarters Air Force Reserve (Robins AFB GA) and Headquarters Air National Guard (Andrews AFB DC) to support their mission requirements. Both headquarters are organized along the same lines of a major command. Where a major command has an Engineering and Services responsibilty over its bases, Headquarters Air Force Reserve and Headquarters Air National Guard have similar Engineering and Services responsibilities over their Reserve units (19:100) and Air National Guard units respectively.

Bases. At base level, the peace-time Engineering and Services function is divided between the Base Civil Engineer and the Chief of Services. The civil engineering squadron is organized for engineering operations, resources

and requirements, engineering and environmental planning, fire protection, industrial engineering, family housing management and financial management. The engineering operations function is sub-divided into separate sections for pavements and grounds, structures, mechanical engineering, electrical engineering and sanitation (26:33,35). The services squadron is responsible for food service, laundry and dry cleaning, exchange service, billeting, furnishings management, commissary management, mortuary affairs, base honor guard, linen exchange and dormitory management (26:65). Support for the war-time Engineering and Services mission is provided by Rapid Engineer Deployable Heavy Operational Repair Squadron Engineer (RED HORSE) which "provide a highly mobile deployable civil engineering response force" (25:6).

Development of the Information Management Problem

To support the Engineering and Services organizations in the performance of their designated responsibilities, many planning and control systems have been employed. These systems evolved in response to several notable pressures.

First, in recent years the facility design function has become increasingly complex. The design process for mechanical and electrical systems has become very sophisticated with the technology of the 1980's. The requirement to satisfy more stringent environmental control

specifications for sensitive equipment and for personal comfort has accelerated this trend. The need to minimize energy consumption and to preserve natural resources and the environment has inspired the total integrated approach to facility design (13:34). This demands greater analysis of facility configurations.

Second, the recent economic problems faced by the United States of America have placed greater strain on the budget of the federal government (68:17). Consequently, more intense competition for resources exists between the Air Force and other government agencies, and between Engineering and Services and other Air Force elements. Furthermore, this has led to an increase in the complexity and detail of analytical and economic studies required to support facility requirements that compete for these resources. Accordingly, more efficient and effective planning and control systems have been sought to better manage the limited resources.

Next, service-oriented organizations, such as Engineering and Services, have no clear quantitative measure of output (8:39). This has attracted increasing Congressional interest for the identification of realistic performance indicators. In response, numerous indicators have been developed. The United States Air Force use Engineering Performance Standards as "a tool...to allow consistent estimating of manhours for maintenance work" and "to provide data for necessary maintenance management

decision-making" (30:9). Collecting data for these indicators involves significant effort.

Another pressure that influenced the development of planning and control systems arose from the size of the management function by Engineering and Services. Engineering and Services manages 133,840 buildings (48). In fiscal year 1983, this function attracted a federal budget apportionment of $5.6 billion (52). The mere size of the inventory of facilities that Engineering and Services manages, and the significant apportionment of funds that it attracts to manage these facilities, provide an indication of the vast quantity of ongoing projects that must be planned, approved, scheduled, tracked and controlled at any one time. This task alone is monumentous. Yet, there also exist the requirements to coordinate the supply of materials, provide rapid response to customer inquiries about the status of a particular project and to provide summary reports to managers at short notice for their decision-making needs.

Finally, higher headquarters have a continuing need to be provided with information on base operational control activities so that their management control responsibilities can be performed effectively.

All in all, these demands have strained the limited resources of Engineering and Services. However, the requirements still existed to maintain a high state of readiness in support of the Air Force mission, to seek more

efficient facility design and construction, and to keep pace with the advanced technology of new weapons systems. The planning and control systems used by Engineering and Services to satisfy these demands consisted of a combination of intensive manual effort and slow-response batch-oriented computer systems.

At base level, the Base Engineer Automated Management System (BEAMS) provides a data processing capability. BEAMS is a software package in the Burroughs 3500 base level computer to support the civil engineering operation. It consists of many subsystems including labor reporting, Prime BEEF (Base Engineer Emergency Forces) composition, work order control, material control, cost accounting, real property accounting, executive management summaries, Civil Engineering Contract Reporting System (CECORS), recurring maintenance program, Pesticide Evaluation Summary Tabulation (PEST) and aircraft Pavement Condition Indices (PCI). Despite this automation assistance, most of the workload is processed manually.

At the major command level, Engineering and Services uses the command's mainframe computers to process their data (21:10). These slow-response, batch-oriented computers allow for the collecting, editing, summarizing and vertical reporting of base level data to Headquarters Air Force (20:1; 22:4). Standard systems processed on these computers include the Command Real Property Inventory system, CECORS, the Base Engineer Emergency Forces

Reporting Analysis and Status System, the Command Civil Engineer and Military Family Housing Costs Systems, and the PEST system (21:10-11). These systems were designed to meet the vertical reporting requirements of the Air Staff, but they have not met the information needs of the major command. Furthermore, this arrangement could not provide timely and current information that met the real needs of the Directorate of Engineering and Services (20:1; 21:33).

The major commands and AFRCEs report design and construction information for major construction projects to the Air Staff using the Design and Construction System (DEACONS). The system is difficult to operate and is unresponsive (3:1). It suffers from a lack of current data due to its centralized data base which must be periodically updated by the reporting organizations. Furthermore, "automated communication between levels of command is limited to monthly updates" (21:13-14).

Despite the existence of data processing systems, about "ninety percent of the Engineering and Services workload" remained as a manual process (22:2). The overall effect of these systems led to Air Staff concern that the information requirements of Engineering and Services at all levels were not being satisfied in an efficient and effective manner. This deficiency also affected the capability for Engineering and Services to accomplish its mission in the most effective manner. To explore this concern further, in 1980 the Director of Engineering

Services at Headquarters Air Force (AF/LEE) directed the Air Force Engineering and Services Center to conduct an Information Requirements Study (28:i).

Engineering and Services Information Management System

The Information Requirements Study aimed to develop a long range plan for the information requirements of Engineering and Services through the 1990s. The thrust of the study was to modernize and simplify base level "data gathering efforts and insure that managers at all levels have the information they require for the management and control of their resources" (28:i). It also aimed to reduce duplication of effort, and integrate the information requirements of Engineering and Services at all levels. It was based on the premise that management information systems form an integral part of an organization and help the organization accomplish its objectives. Specifically, the study looked upon information as a data base for operational day-to-day activities while applications of a management information system provided the control process to use this information in the attainment of organizational objectives.

The results of this study found that the information requirements of civil engineering functions were characterized by a large diversified data base, rapid retrieval of information, and vertical transmission of data. The information requirements for the services

functions were found to be characterized by rapid transaction processing, point of sale control, independent data bases, and vertical transmission of data. The study concluded that the information requirements of Engineering and Services at all levels were not being satisfied completely nor in a timely fashion by existing planning and control systems (20:2). Furthermore, the study found that one automated data processing system could not satisfy all base, major command, or Air Staff requirements (21:16).

Headquarters Air Force recognized the impact of these findings and focused its attention on overcoming the problem. In the Engineering and Services Strategic Plan, Major General C. D. Wright, Director of Engineering and Services, identifies the need for improvement of "procedures to enable the Base Civil Engineer and Chief of Services to do their jobs more effectively" as one of the ten goals in which efforts should be directed to accomplish the Air Force mission (24:8). One of the two objectives to be achieved in attaining this goal is the development, refinement and acquisition of "Engineering and Services Information Management Systems (ESIMS) to better serve all levels of Engineering and Services" (24:8). Thus the ESIMS is the approach adopted to satisfy the information requirements identified in the Information Requirements Study.

ESIMS is a distributed data management system that can be accessed at all levels of command. It spans the entire

Engineering and Services organization and comprises the following information management systems (21:17,19):

1. Base Civil Engineer Information Management System (BCE IMS).

2. Services Information Management System (SIMS).

3. RED HORSE Information Management System (RED HORSE IMS).

4. Major Command Engineering and Services Information Management System (MAJCOM IMS).

5. Air Force Regional Civil Engineer Information Management System (AFRCE IMS).

6. Air Force Engineering and Services Information Management System (AFESC IMS).

7. Headquarters Air Force Directorate of Engineering and Services Information Management System (LEE IMS).

The interrelationships of these systems are depicted in Figure 1. An important concept to note about these systems is the interrelationship each shares with WIMS, existing main-frame systems, commercial time-sharing systems and the Integrated Graphic System (IGS).

ESIMS is not a single computer system. It is a network of interrelated computer systems that are linked together to support the mission of Engineering and Services organizations at each level of command. The concept of ESIMS is focused at meeting worker needs at the individual level rather than solely the organizational requirements. Furthermore, ESIMS integrates the need for workers to communicate with other workers. This new concept is based upon worker needs and builds upon these needs to form the

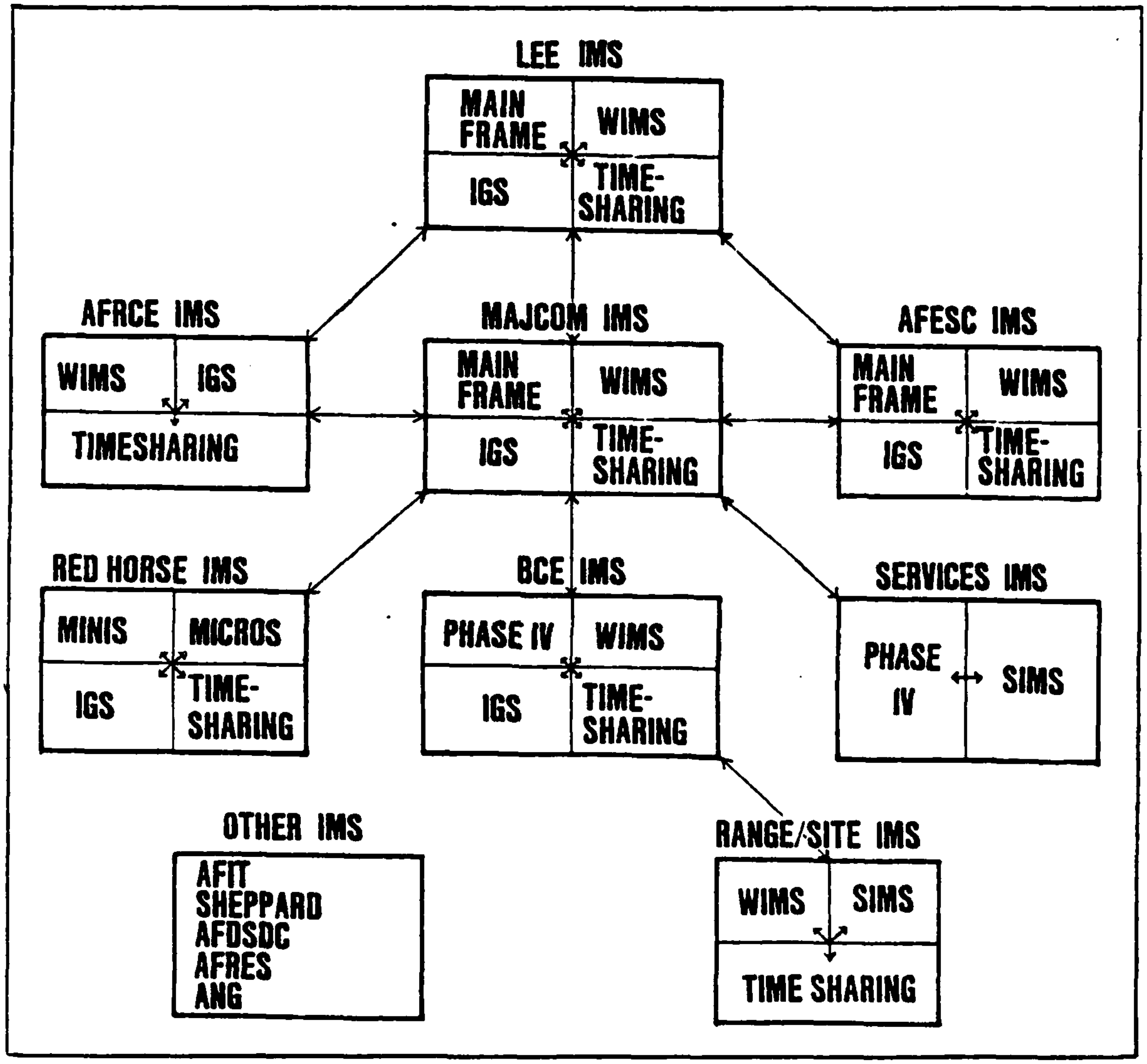

Figure 1. Engineering and Services Information Management System Network (21:19)

various computer systems and the ESIMS network. This approach contrasts strongly with the traditional concept of management information systems which is based upon developing a system top-down by imposing a structure of computer systems on the worker without regard to individual information needs. Thus, the different emphasis in ESIMS from other concepts is its user orientation.

The Engineering and Services Strategic Plan identifies sixteen major strategies to be employed in the attainment of the ESIMS. As ESIMS is a distributed decentralized system, the various strategies form a continuum of development, testing, implementation and analysis of the ESIMS component systems. Thus, implementation problems can be detected early and rectified before the system is fully implemented world-wide. The major strategies are as follows:

1. Establish WIMS at each MAJCOM, AFRCE and at AFESC through leasing in fiscal year 1983 as a temporary measure, and through centrally acquired systems in fiscal year 1984 as a permanent measure.

2. Establish the LEE IMS in 1983.

3. Decentralize DEACONS and expand it to the Programming, Design and Construction (PDC) System for implementation at the Air Staff, MAJCOMs and AFRCEs in 1983.

4. Prototype the base level WIMS in fiscal year 1983, test at three bases in 1984, and field Air Force wide by 1987.

5. Establish the RED HORSE IMS by 1986.

6. Develop and field the base level SIMS at one base in 1984 and field Air Force wide by 1988.

7. Develop and field the Integrated Graphics System (IGS) at all levels of command by 1988.

Most of these strategies function within more than one of the seven management information systems that comprise ESIMS. "WIMS and SIMS form the backbone of ESIMS. The other strategies build upon and integrate with WIMS and SIMS to develop ESIMS to maturity" (4:3).

Work Information Management System

Initially WIMS was intended to automate the manual task of job order processing at base level (29:2). At the end of 1982, the proposed system was expanded to cover all base level civil engineering functions that were not on BEAMS and to include the data automation requirement for the major commands and AFRCEs. Thus WIMS will be implemented at all levels of the Engineering and Services organization and over a much broader range of functions (49:1).

Three basic types of WIMS exist--the MAJCOM system, the AFRCE system and the base system (22:22). To prepare for the world-wide implementation of WIMS, computer systems have been leased by the MAJCOMs, SOAs and Air Staff. Early leasing provides the opportunity to learn from problems that may arise from live operation of WIMS and while the world-wide WIMS system is still being developed. Furthermore, this opportunity provides the means to transition DEACONS to the centralized PDC system with a distributed data-base at the MAJCOMs and AFRCEs.

The leased MAJCOM system was implemented during 1983 and the early part of 1984. It was installed at major commands, the Air Force Engineering and Services Center, Headquarters Air Force (LEE) and Headquarters Air Force Reserve, and is yet to be installed at Headquarters Air National Guard. The leased AFRCE system was implemented at the five AFRCEs during 1983. Figure 2 depicts the location of the organizations that are in the United States; Figure 3 depicts the overseas locations.

All of the leased systems will be replaced as part of the world-wide implementation of WIMS at all levels of command. The world-wide implementation also includes the installation of 107 systems for 104 bases from 1984 to 1987 (2:56-63; 22:22). This study focuses only on the implementation of the leased MAJCOM and AFRCE systems.

<u>MAJCOM and AFRCE Work Information Management Systems</u>

The objectives of the MAJCOM and AFRCE WIMS are as follows (20:2; 22:18):

1. Improve data availability to result in more timely and more informed decisions.
2. Reduce the need for manual data reductions.
3. Improve response time in decision-making.
4. Decrease the probability of error in decision-making.
5. Improve data flow between bases and major commands, and between major commands/AFRCEs and Headquarters Air Force (LEE)/Headquarters Air Force Engineering and Services Center.
6. Reduce administrative time in producing reports.

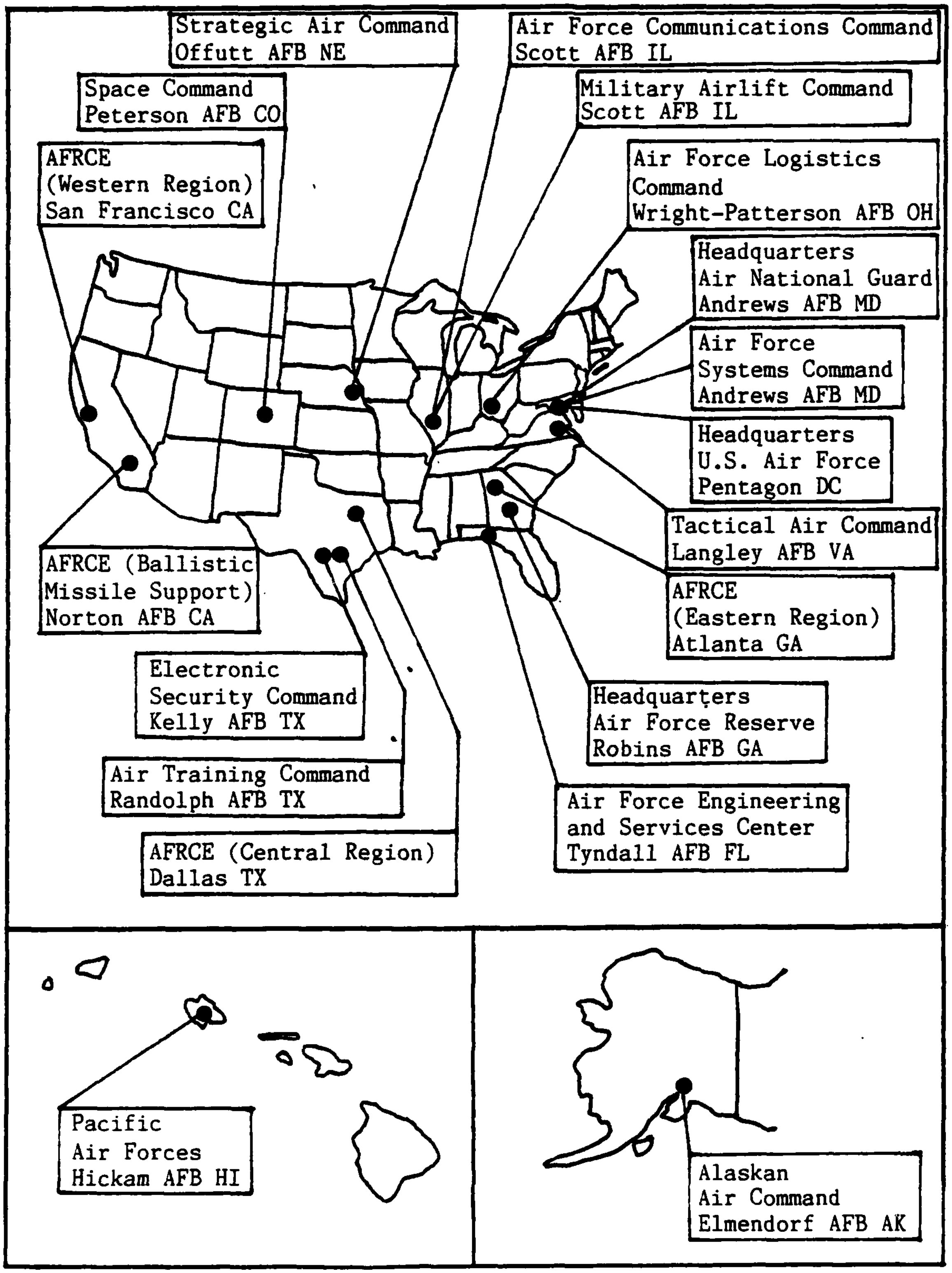

Figure 2. U.S. Locations of MAJCOM and AFRCE WIMS

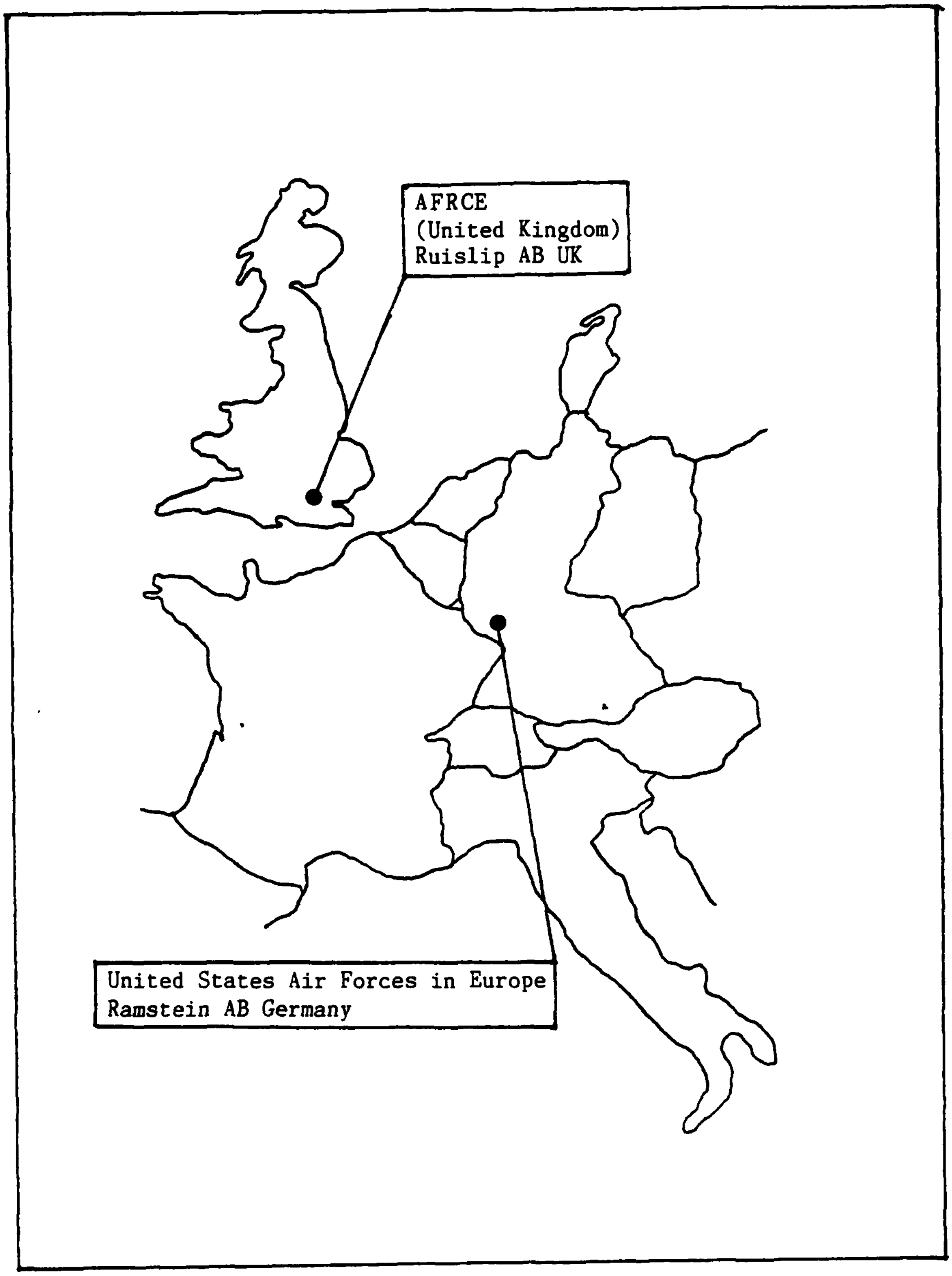

Figure 3. Overseas Locations of MAJCOM and AFRCE WIMS

7. Improve productivity of personnel.

8. Reduce the effort and time involved in acquiring, processing, delivering and using information in the work place.

9. Enhance decision-making.

The software capabilities of WIMS are structured into a standard core of applications and an optional model. The standard core is a fixed system that can only be modified by the Data Systems Design Office at Gunter AFS AL. The optional model can be created and modified by users to suit their own applications (22:1). Thus the optional model is a tool for the worker to use to improve his job performance. The standard programs are "structured by directorate and division and can be arrayed by base. The type programs that are available are resource allocation, status reporting and administrative" (22:6).

The software package for the MAJCOM and AFRCE Work Information Management System is based on the prototype system operated at Headquarters Tactical Air Command (TAC), Langley AFB VA. It contains the capability to store, access, retrieve, manipulate, report and transmit data on many activities including:

1. duty rosters

2. personnel manning

3. suggestion programs

4. readiness

5. design and construction

6. environmental planning

7. finances
8. housing
9. fire services
10. vehicle status
11. training status
12. in-service work projects
13. material control
14. airfield pavement evaluations
15. airfield characteristics
16. electrical utilities
17. mechanical and electrical plant systems
18. gas utilities
19. boilers
20. CECORS
21. facility listings and descriptions
22. real property inventory
23. military construction programs.

There are approximately 500 defined reports in the MAJCOM system and 100 reports in the AFRCE system (22:6).

The Program, Design and Construction (PDC) System has also been loaded on WIMS as a standard application. The PDC System replaced DEACONS in 1983 (28:i).

Using the menu-driven utility, users can create files, store data, create screen displays, generate reports, and transfer files to other systems. The optional software also supports word processing, business graphics, electronic file transfer and network analysis (2:1; 24:2).

The hardware configuration for WIMS differs slightly between the MAJCOM and the AFRCE. Also there are three sizes of the MAJCOM system--small, medium and large. Table I describes the configuration for systems involved in the centrally procured world-wide purchase. The leased systems, which are the subject of this study, are smaller and vary in size considerably because each system was leased locally by each MAJCOM and SOA.

Implementation of the Leased MAJCOM and AFRCE WIMS

The implementation schedule for the leased MAJCOM and AFRCE WIMS was as follows:

1.	Tactical Air Command	Jan 82
2.	AF Engineering and Services Center	Apr 83
3.	AFRCE - Eastern Region	Aug 83
4.	Air Force Systems Command	Aug 83
5.	Pacific Air Forces	Aug 83
6.	AFRCE - Central Region	Sep 83
7.	AFRCE - Western Region	Sep 83
8.	Alaskan Air Command	Sep 83
9.	Headquarters Air Force Reserve	Sep 83
10.	Headquarters Air Force	Sep 83
11.	Military Airlift Command	Oct 83
12.	Space Command	Oct 83
13.	Strategic Air Command	Oct 83
14.	Air Force Logistics Command	Nov 83
15.	Air Training Command	Nov 83

TABLE I

Hardware Configuration for WIMS
(Adapted from 2:56-63; 22:22)

Organization	MAJCOM Lge	MAJCOM Med	MAJCOM Small	AFRCE
Headquarters Air Force	X			
Headquarters Air Force Reserve			X	
Headquarters Air National Guard			X	
AF Engineering and Services Center	X			
Air Force Communications Command			X	
Air Force Logistics Command	X			
Air Force Systems Command			X	
Air Training Command		X		
Alaskan Air Command			X	
Electronic Security Command			X	
Military Airlift Command	X			
Pacific Air Forces		X		
Space Command		X		
Strategic Air Command	X			
Tactical Air Command	X			
US Air Forces in Europe	X			
AFRCE (Ballistic Missile Support)				X
AFRCE (Central Region)				X
AFRCE (Eastern Region)				X
AFRCE (United Kingdom)				X
AFRCE (Western Region)				X
Hardware Component				
Work station (data processing)	26	20	14	10
Work station (data/word processing)	26	20	14	6
Printer matrix LQ	8	6	4	2
Twin sheet feeder for matrix printer	7	5	3	1
Work station (graphics)	2	2	2	1
Printer daisy LQ	2	2	2	1
Magnetic tape drive	1	1	1	-
Band printer - 600 LPM	1	1	1	-
Forms tractor	1	1	1	1
Twin sheet feeder	[illegible]	1	1	1
Central processing unit - 512 KB	-	-	-	1
Central processing unit - 1024 KB	-	-	1	-
Central processing unit - 2048 KB	1	1	-	-
288 MB disc drive	2	2	2	-
75 MB disc drive	-	-	-	1
Professional computer	-	-	-	2
Printer matrix	-	-	-	2

16.	US Air Forces in Europe	Dec 83
17.	AFRCE - United Kingdom	Dec 83
18.	AFRCE - Ballistic Missile Support	Jan 84
19.	Air Force Communications Command	Mar 84
20.	Headquarters Air National Guard	late 84

Although the world-wide implementation of WIMS includes Electronic Security Command, this command has not implemented WIMS on its leased system and thus does not appear on the above implementation schedule.

WIMS is to be integrated into the daily work routine of every person in the organization through the creation of work stations. Users of the system range from the Director of Engineering and Services to the clerk. The implementation strategy adopted by the Air Force Engineering and Services Center for the MAJCOM and AFRCE systems focused on the user. Specifically, user acceptance was sought by using an approach in which the system became integrated within the work environment as opposed to a top-down, forced approach. This was approached through user exposure to the system and basic training.

Training consisted of 3-day training sessions at AFESC for the system administrators and operators. The AFESC implementation team that up-loaded the TAC Headquarters software at each major command and AFRCE provided several days of assistance during their visit. Each major command and AFRCE was then responsible for training the users within their own organizations. Further specialist

training was made available by the computer vendor for system administrators and operators, word processing managers, and programmers.

Justification

Air Force Engineering and Services employs 62,579 personnel and is responsible for managing some 133,840 buildings (48). These facilities are located on 2996 installations world-wide with a replacement cost of $96 billion (33:2). In fiscal year 1983, Engineering and Services attracted a federal budget apportionment of $5.6 billion (52). These assets and resources must be skillfully managed by effective planning and control systems to ensure that tasks are carried out effectively and efficiently, to ensure that resources are used effectively and efficiently and to ensure that objectives are accomplished in an effective manner.

WIMS is a computer-based management information system that is being introduced to the Engineering and Services component of the United States Air Force. Early leasing of computers at the Air Staff, MAJCOMs and SOAs provides the opportunity to analyze WIMS in operation before the world-wide purchase is fully developed and committed. The system aims to improve storage, access, retrieval, monitoring, manipulation, reporting and transmission of information with the result of improving individual job performance and overall organizational effectiveness. It will operate at

bases, major commands, separate operating agencies and at the Air Staff. The total budgeted cost for the system is $95 million (22:19).

The Work Information Management System is a tool by which the information necessary for decision-making in managing resources and conducting operations is effectively and efficiently stored, accessed, retrieved, monitored, manipulated, reported and transmitted. Moreover, since WIMS is a new concept in management information systems in that it is user-oriented rather than management-oriented, it needs to be evaluated. Also, the size of the financial investment in the Work Information Management System and the significance of the tasks it supports justify that effort be expended to understand what factors promote the success of this system to accomplish its objectives and what factors jeopardize success of this system to accomplish its objectives.

User attitudes have been found to be related to the success of other management information systems and this knowledge has given managers an added advantage in promoting a system's success (14:11; 58:146; 60:13,58; 61; 62; 69; 70; 71:70-78; 76; 81). However, the relationship between user attitudes and system success is not clearly known, nor is it known how other factors may affect this relationship. Clearly, different implementation strategies at each MAJCOM/AFRCE could help explain differences in user attitudes and success of the Work Information Management

System. Other factors such as a user's age, educational background and computer experience may also explain such variation in user attitudes and system success. Accordingly, there is value in studying the variables that may affect user attitudes and the success of the Work Information Management System.

Problem Statement

Before WIMS is implemented world-wide, computer systems are being leased at the Air Staff, MAJCOMs and SOAs to enable early implementation of the WIMS concept and to enable early transition from DEACONS to the PDC system. Early leasing of these computer systems began throughout 1983 and the early part of 1984. During the period of 1984 to 1987, the world-wide purchase of computers for WIMS will be implemented for bases, MAJCOMs, SOAs and the Air Staff. Thus, it is the early leasing of computers that has provided the opportunity for WIMS to be implemented early at the MAJCOMs, SOAs and Air Staff, and that has provided the opportunity for this study to analyze the implementation of WIMS.

It is not known whether user attitudes actually relate to the success of the Work Information Management System at the major commands, separate operating agencies and Air Staff. If user attitudes do relate to success, it is not known how they relate. Finally, it is not known whether factors such as the age of users, the educational

background of users, and the computer experience of users affect attitudes and success of the Work Information Management System.

Thus, the problem that needs to be addressed is to determine whether user attitudes relate to success of the Work Information Management System at major commands, separate operating agencies and at the Air Staff, and if so, how do user attitudes relate to success. The problem also involves the need to determine whether the user's location (major command, separate operating agency or Air Staff), age, educational experience, and computer experience affect user attitudes and the success of the Work Information Management System.

Scope and Limitations

This study examines the user attitudes and success of the MAJCOM and AFRCE Work Information Management Systems. It is limited to only those organizations with a leased MAJCOM or AFRCE Work Information Management System. Thus, the study focuses on the 12 major commands, the 5 Air Force Regional Civil Engineer offices, Headquarters Air Force, Headquarters Air Force Reserve, and the Air Force Engineering and Services Center.

Success of the Work Information Management System is operationally defined by the degree to which the system achieves its objectives. The degree to which the system achieves intermediate objectives--such as satisfactory

technical design, operation, development, prototyping, testing, documentation and support--are not considered as a measure of success in this study because it is subordinate to the system's success in achieving its overall objectives. The objectives of the Work Information Management System are discussed in considerable detail in Chapter III.

Many variables may relate to the success of the Work Information Management System, but this study primarily explores the potential relationship between user attitudes and success. This study also explores the effect of user location (major command, separate operating agency and Air Staff), user age, user educational background and user computer experience on user attitudes and success of the Work Information Management System.

Research Objective

The objective of this study is to determine if there is a relationship between user attitudes and success of the MAJCOM and AFRCE Work Information Management Systems, and if there is, what is this relationship. Furthermore, this study seeks to determine what effects user location (major command, separate operating agency or Air Staff), user age, user educational background, and user previous experience with computers might have on attitudes and success.

Research Questions

To explore the research objective, two research questions were developed. These are as follows:

Research Question 1

> What is the relationship between user attitudes and success of the Work Information Management System at major commands, separate operating agencies and the Air Staff?

Research Question 2

> How is the potential relationship between user attitudes and success of the Work Information Management System affected by the user's location (major command, separate operating agency or Air Staff), the user's age, the user's educational background and the user's previous experience with computers?

The first research question was developed to simply determine whether a relationship exists between user attitudes and success of the Work Information Management System, and if found, to determine what the relationship is. The second research question is much more exploratory than the first. Regardless of whether a relationship is found or not, it seeks to explore how demographic variables about the user affect not only user attitudes and success of the Work Information Management System, but also how these demographic variables affect the relationship between user attitudes and success.

II. Literature Review

Overview of Presentation of Literature

This literature review begins with an exploration of the literature on computer-based management information systems and on the success of management information systems which is the postulated dependent variable for the study. Using Leavitt's model (44:5), the discussion on management information systems is placed in the organizational setting which is then focused toward the need to evaluate management information systems for success or failure. Then, an approach to defining the success of a management information system is developed to provide a basis for evaluation.

Next, the review reports on the behavioral factors that affect the success of a management information system and presents a thorough description of significant theories and research findings. This portion of the review forms the framework for isolating the variables under consideration in the research objective. These behavioral factors form the set of independent variables for the study.

The main independent variable of interest is treated next. User attitudes are discussed from both a theoretical and empirical perspective. The theoretical discussion focuses on and explores the concept of an attitude. The

empirical discussion on user attitudes reports on the various empirical studies that have been conducted by researchers to determine the relationship of user attitudes with success of management information systems.

Finally, the literature review discusses the four other independent variables of interest--user location, user age, user education and user experience with computers--focusing on empirical findings of how these demographic variables affect user attitudes and success of management information systems.

Management Information Systems

The computer-based management information system provides people in an organization with a tool to execute tasks. Within the organizational setting, the computer-based management information system "can be defined in terms of the Leavitt model of the organization as part of the technology the organization employs" (44:5). The Leavitt model of the organization is illustrated in Figure 4.

The Leavitt model provides a framework for the study of computer-based management information systems in relation to the organization, its people and its tasks. Gremillion (44:5-7) identifies three distinct approaches to management information system development/implementation theory using this model. These approaches are systems planning, systems engineering, and management

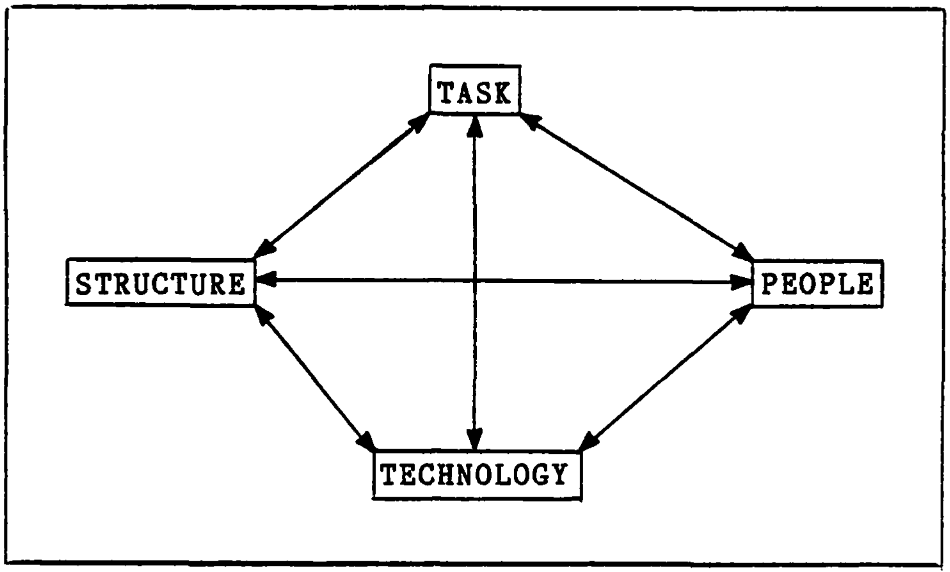

Figure 4. Leavitt Model of the Organization
(Reprinted from 44:5)

science/management information system (MS/MIS) implementation.

The systems planning approach focuses on the relationship between technology (the computer) and the tasks and structure of the organization. This approach is relevant to studies of the framework for information systems design and systems development process models in which an appropriate management information system is specified in relation to given tasks and structure of the organization. Usually, the user's needs are studied to determine what is to be computerized.

The systems engineering approach concentrates on the technological design of the management information system itself. That is, knowing what needs to be computerized, how can it be computerized efficiently and effectively.

Such studies are the focus of systems analysis and systems engineering texts in which techniques are provided on how to build a well-designed management information system.

The Management Science/Management Information System (MS/MIS) implementation approach (sometimes referred to as the Operations Research/Management Science (OR/MS) implementation approach when related to models rather than management information systems) focuses on the relationship between the model or system and the persons and structure of the organization. The main interest here is given that a management information system is to be implemented, how can the organization ensure that this valuable tool will succeed. Implementation of OR/MS tools have received the widest attention in this area of research in response to a growing concern over systems that have been developed but have failed to be used upon implementation (60:4). As the implementation of OR/MS models and the implementation of management information systems have many similarities and very few differences, both have been treated interchangeably in the literature (42; 44; 54; 60:3).

These three approaches form a hierarchy of steps to successful implementation of management information systems. Figure 5 illustrates how systems planning involves the selection of the right application to computerize. The diagram also shows that systems engineering involves the analysis of the management information system for efficiency and effectiveness.

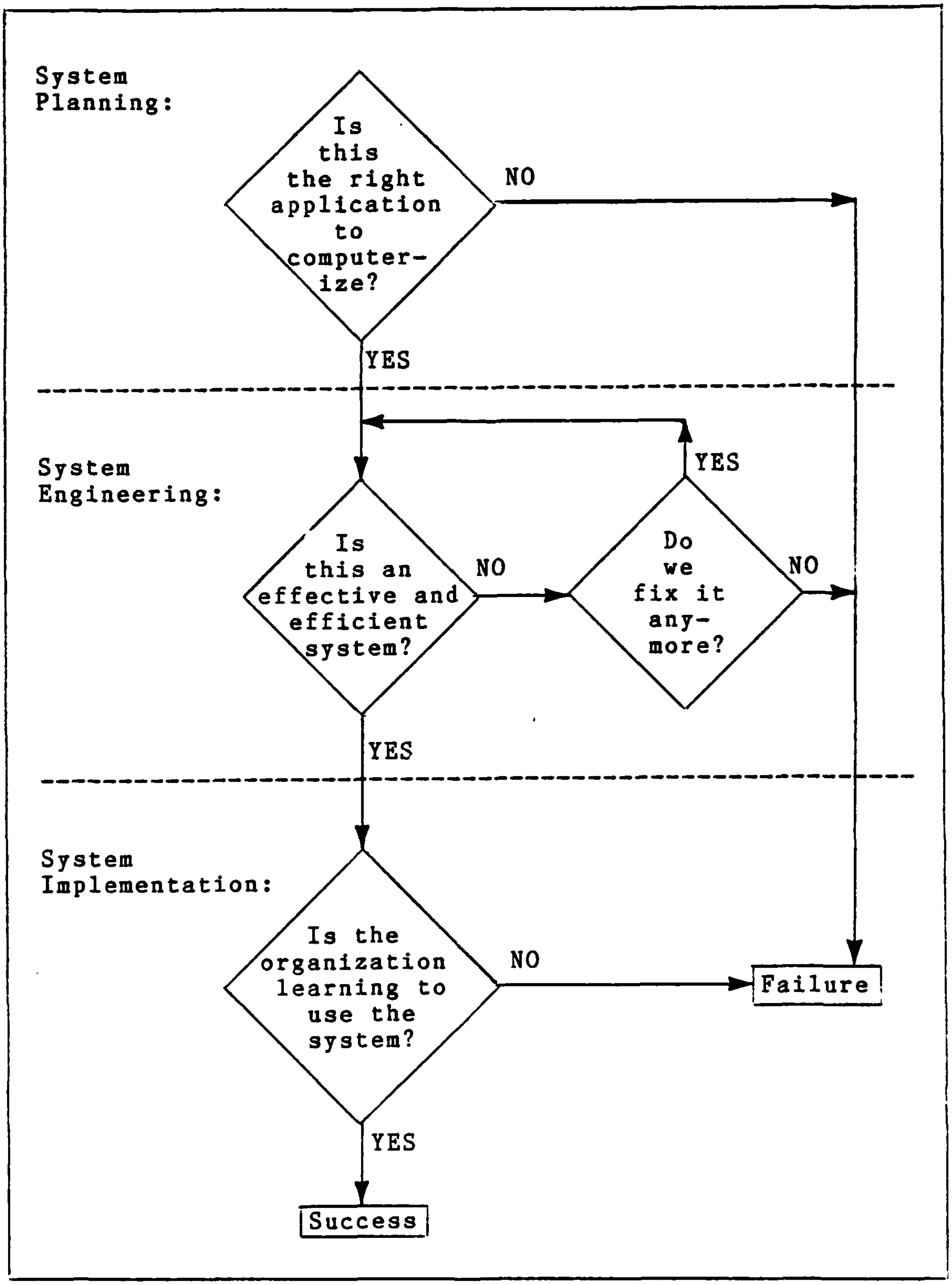

Figure 5. Hierarchy of Steps to Successful Implementation of a Management Information System (Reprinted from 44:8)

Finally, system implementation is shown as the final step in which the organization actually makes use of the system in accordance with the objectives of the system.

A management information system can be considered to have four main stages in its life cycle: planning, purchasing, implementing and utilizing (57). Using this framework, Frederico et al describe implementation as "the introduction and subsequent use of a management information system whose purpose has been defined in some manner" (37:12)

This literature review focuses on this last approach - the study of successful implementation of management information systems. It will review literature on the implementation of both OR/MS models and MS/MIS systems. The intent is to report the literature that is applicable to the subject of successful implementation of a management information system model but within the scope of the research objective of this study.

Implementation Success of Management Information Systems

Management information systems involve a significant investment of organizational finances and resources. Evaluation of management information systems is necessary to validate the purpose of the system (84:94). Hence, evaluation of the performance of a system has attracted wide interest from researchers and managers alike.

The dependent variable of major interest in the implementation of a management information system is "the degree to which the implementation effort was successful" (40:86). Extensive efforts have been expended in the search for understanding how systems succeed and why systems fail. But the first effort in any evaluation study is to define success and failure.

Evaluation of management information systems for success or failure can take on many dimensions. Zmud states that "evaluation of MIS success is a complex and perplexing issue" (85:969). Green and Keim were able to categorize this wide variety of processes into three categories: performance, interface and change (43:11).

Evaluation of performance relates to the stated goals of the system. Operationally, performance can be defined "as the level of goal achievement" (43:11). Evaluation of the interface involves an examination of the degree to which the system interacts with other resource units. Measures of this process include user satisfaction with the results of using the system. Evaluation of change concerns the overall process of change at the individual, group and organizational levels. The important aspect of change is that it must be continuously monitored, evaluated and managed to insure proper system performance.

In this literature review, the focus is on implementation. Hence, the measure for success should evaluate implementation success. The major issue in

implementation is that the management information system is successful in fulfilling its objectives.

Goals are fundamental to the implementation and evaluation of a management information system. Ginzberg stated that:

> Goals, the notion of what we are trying to accomplish, should be an integral part of the evaluation of any OR/MS project. After all, a project can be truly successful only if it accomplishes what it was supposed to [41:61].

Birks also agrees that goals are the basis for any computerized management information system. He states that "an information system should be designed to meet specific objectives" (9:45). A similar view is provided by DeGroff. In the evaluation of a management information system, he stresses the importance "to clearly identify the objectives the information systems are intended to meet" (18:4).

Thus the emphasis on computer performance evaluation is on goals and not just on quantifiable variables of computer performance such as usage. In some cases usage may be an effective indicator of performance particularly if the goal of the system is based on usage. However, it has been argued that "misuse" is a form of usage, and therefore, the value of a usage variable as an indicator of performance can be weakened. In most cases, ""use", by itself, is an inadequate measure of effectiveness; relying too heavily on it as a criterion for evaluation could result in erroneous assessments of our effectiveness" (41:59).

In those cases where usage is a goal of the system--in these cases we refer to the system to be operating under mandatory use--the usage measure can still present problems. Mandatory usage can involve willing use or reluctant use, and in the latter case, a measure of usage may not be measuring what is really important.

Zmud summed this situation up in a similar fashion but more from the organizational perspective of decision making. He considered actual usage as an escape from the problem of MIS performance measurement, and stated that "success ultimately depends on how well the MIS has, in fact, supported decision making" (85:969).

Ginzberg contends that user satisfaction with the result of a model (or a management information system) better measures implementation success than does use (40:86). As an illustration, an unsatisfactory management information system may still be used because it may be the only one available. In this case, satisfaction would be a better measure than use. Ginzberg concludes that use is "not an adequate criterion for differentiating successful from unsuccessful projects" (40:98). Although user satisfaction can be a better measure of implementation success, he suggests that further research is required in this area. This is because of the significant importance that the definition of implementation success has on the results of an implementation study (40:98).

As is evident from the above, numerous measures could be constructed to evaluate a management information system and thus provide a measure of its success. The most important point to note is that the measure should be tailored to what is being evaluated. Therefore, the measure for success will be unique to the situation surrounding the system to be implemented. Accordingly, success measures should be specifically tailored around the objectives or goals of the system. This conclusion can be summarized as follows:

> Once a goal for the project has been agreed on, an appropriate measure (or measures) of effectiveness, of project success or failure, can be defined . . . The key point is that the appropriate measure of effectiveness depends upon the intent of the project, its goals [41:61].

In summary, the goal of a system could be related to any or all of the processes--performance, interface and change. The key point is to focus evaluation for success of a management information system on the goals of the system itself. These goals provide the basis for a system to be evaluated. Without a definition of implementation success, a management information system can not be meaningfully evaluated (55:204).

Behavioral Factors Affecting the Success of a Management Information System

The success of a management information system, or the degree to which the management information system achieves what it is supposed to achieve, is an area of research that

has received wide attention. On the technical side, significant advances in computer capabilities have widened the application of computer technology to areas that were considered impossible or impractical just several years ago. Such advances have raised the computer to new heights of complexity, speed and accuracy that are beyond the rational comprehension of man. So much research and design is expended in this area that failure due to faulty design is rare.

Where failures do occur and where success can be easily jeopardized is with the involvement of human factors. Since people input information into the computer, and since people use output information from the computer, behavioral or human factors are primary determinants of the effectiveness of a management information system (84:312). People have different values, needs and wants, and these factors are important for encouraging human "support for the design and implementation of an information system" (84:313).

Inappropriate implementation strategies can lead users of the system to resist, and in some cases, sabotage the system. Many attempts have been made to explain and/or model the behavioral factors that are considered to play an important role in influencing the ultimate success or failure of a management information system. There is no universal agreement as to how management information

systems behave, but most of the research findings do display some common themes.

Lucas has conducted extensive research into the behavioral side of management information systems. He developed a descriptive model of the use and performance of an information system. Figure 6 depicts this model. The model consists of situational, personal, attitudinal and decision style variables and system quality and relates these to system usage and individual performance.

The model shows that attitudes and perceptions are based upon the user's evaluation of the quality of the system. This proposition is also supported by Ein-Dor and Segev (35:1073). In turn, attitudes and perceptions, situational and personal factors, and individual performance directly influence the use of an information system. Use is then modified by the user's decision style in determining actual behavior. This behavior then combines with situational and personal variables to influence how the individual performs.

The model also displays a cyclical relationship between usage and user performance. If performance increases as a result of using the system, the user will use the system more. If, on the other hand, use of the system decreases individual performance, then the user will be inclined to reduce use of the system. Likewise, if the user makes greater use of the system, he is more likely to gain an increase in his performance. And similarly, if the

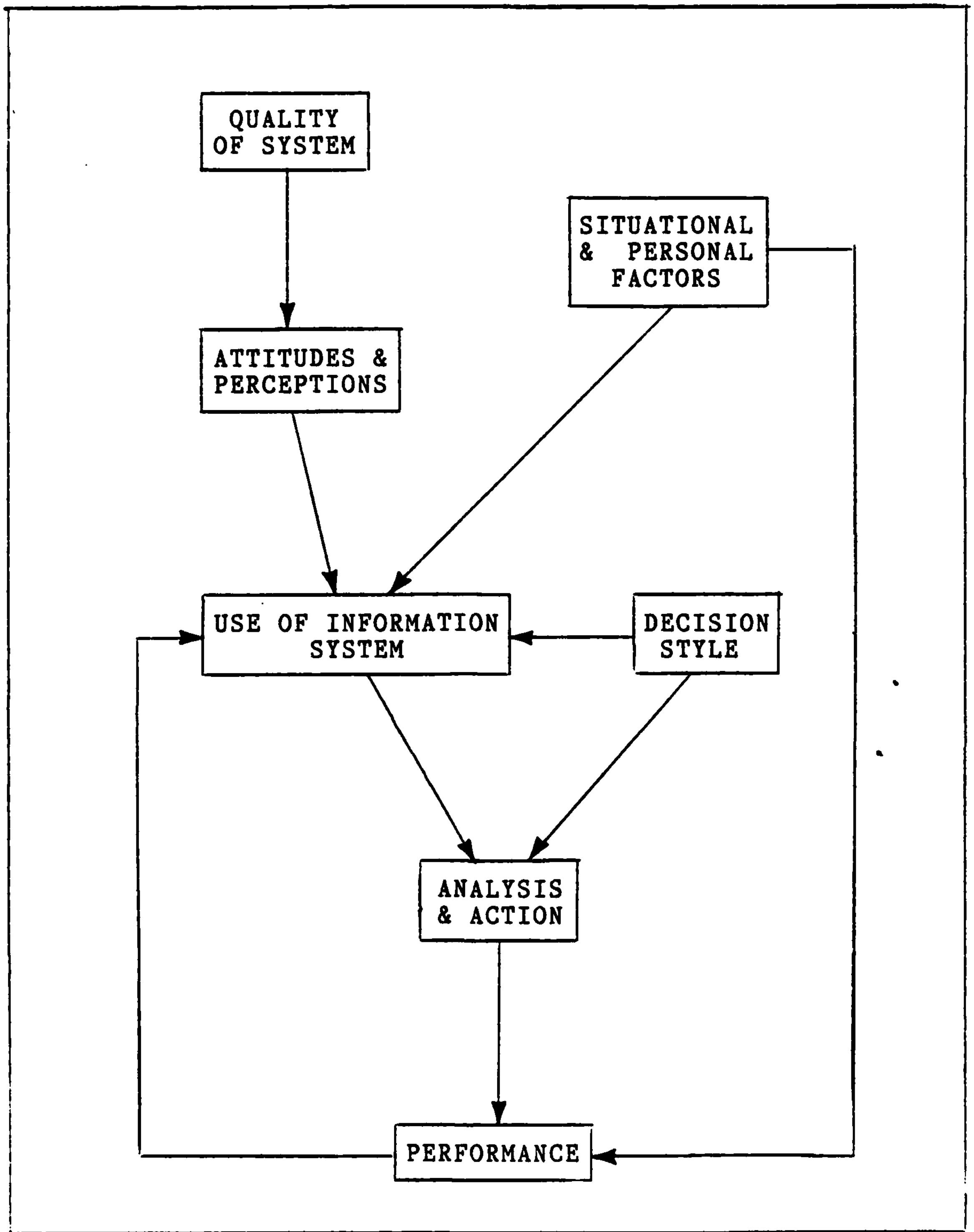

Figure 6. The Lucas Descriptive Model of the Use of an Information System and Performance (reprinted from 51:913)

system is used infrequently, then there is little chance that the system could improve performance.

Lucas subsequently developed a modified model which he validated empirically. Figure 7 illustrates this modified model which depicts six variables as the components of the model:

a. model characteristics,

b. general user attitudes and perceptions,

c. user attitudes toward the model,

d. decision style of the user,

e. situational and personal variables, and

f. implementation success.

In most of his studies as in this one, Lucas adopts usage as the measure for the dependent variable of the model--successful implementation--but there is no reason why other measures could not be adopted instead. An alternate measure would be particularly appropriate if use was mandatory, in which case usage of the model would not differentiate between successful and unsuccessful implementation. Lucas also points out that the measure of successful implementation should accord with the goals of the computer system as defined by management.

User attitudes are presented as the focal point of interest in the set of five independent variables that comprise this model. Lucas states that "attitudes are a good predictor of behavior" and "knowing something about an

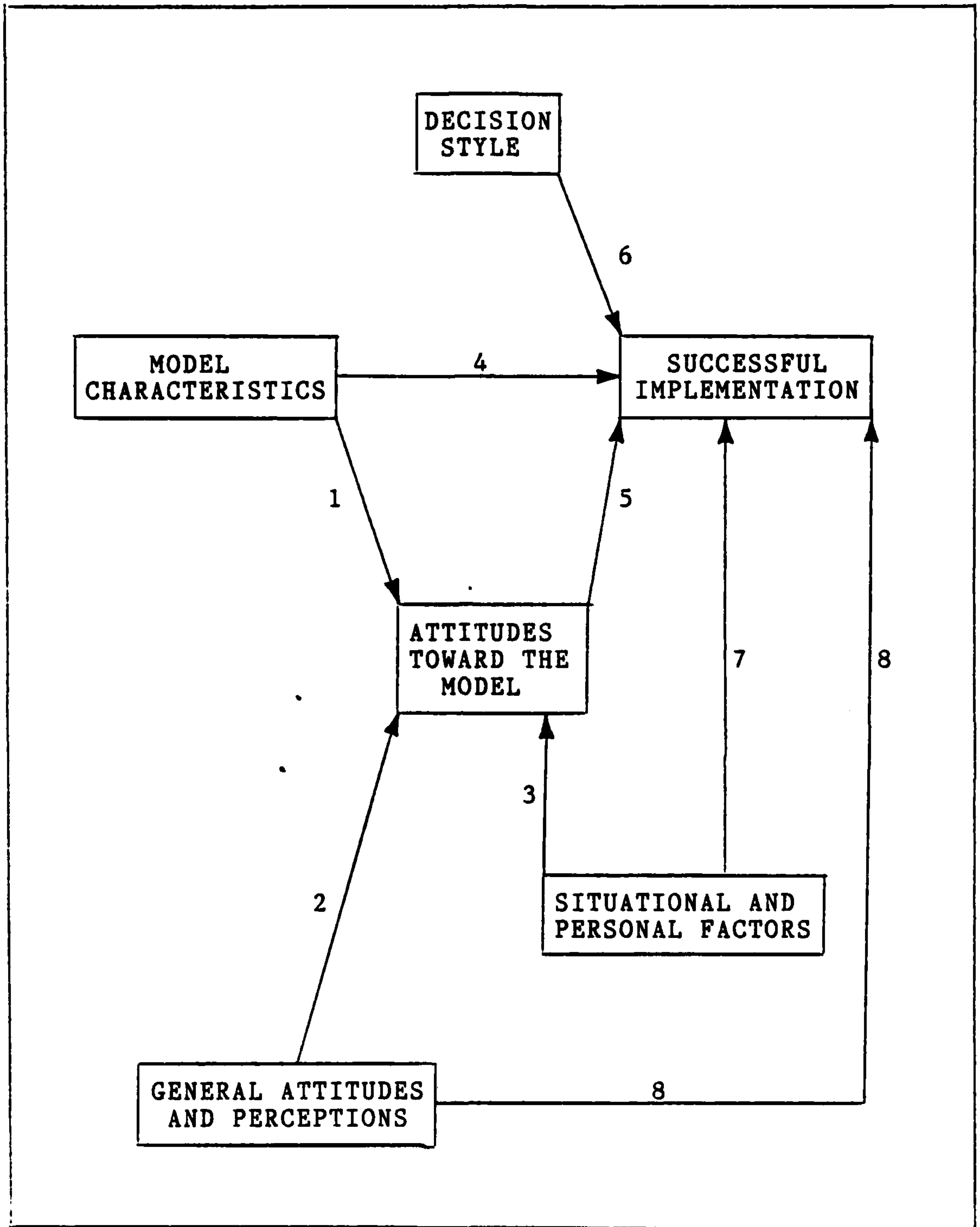

Figure 7. The Lucas Descriptive Model of Successful Implementation of a Computer-Based Model (Reprinted from 60:19)

individual's attitudes provides the basis for making predictions of how he will act" (60:13).

The model was developed from observation of a number of case studies. It shows an association between situational and personal factors and attitudes toward the computer-based model. According to Lucas such relationships have been demonstrated for specific cases, but the direction of the association is difficult to predict for the general case. Nevertheless, he points out that for a specific case, knowledge of the organizational and environmental context of the research should assist in establishing the direction of this relationship (60:15).

Another relationship that is depicted in the Lucas model at Figure 7 is the relationship between attitudes and successful implementation. Lucas based this proposition on past research (61; 81) which has strongly supported this.

Situational and personal factors are also shown to be associated with the successful implementation of an interactive computer-based model. Such a relationship has been substantiated in previous research by Schultz and Slevin (76) and Lucas (61); however, as with the relationship between situational and personal factors and attitudes, one needs to carefully consider the specific case to conclude direction of this relationship (60:17).

Lucas conducted a study of the use (the measure for successful implementation) of an on-line computer-based

TABLE II

Empirical Results of Validation of the Lucas Descriptive Model of Successful Implementation of a Computer-Based Model (Reprinted from 60:19)

Relationship (as numbered on the model in Figure 7)	Strength of Relationship
1	moderate
2	moderate
3	moderate
4	strong
5	strong
6	weak
7	moderate
8	moderate

planning model in a sample of firms to test the validity of his model in Figure 7. The results of his study provided the evidence shown in Table II to support his model.

The conclusion drawn from the work by Lucas is that a strong relationship can be expected between user attitudes and successful implementation, and a moderate relationship can be expected between situational and personal variables (e.g., user location, age, education and previous computer experience) and user attitudes and between situational and personal variables and successful implementation. Furthermore, Lucas concluded causality exists in which model characteristics and situational and personal variables preceded the development of user attitudes and successful implementation. For the other variables, Lucas

concludes a mutual influence relationship exists. For example, high levels of use and successful implementation can be attributed to favorable user attitudes, yet favorable user attitudes can be the result of high levels of satisfactory use and successful implementation. So a cycle of mutual influence is thought to exist (60:65); however, this cycle is not depicted in his model in Figure 7.

Zmud (85) also developed a model of MIS success. The focus of his model was on individual differences and how these differences impacted upon MIS success. Despite this focus, it is a useful model because it does address the other variables involved in affecting the potential for a management information system to succeed or fail. Figure 8 illustrates his model. The relationships between the variables are intended to be indicative of association rather than causality.

In this model, MIS success is influenced by cognitive behavior and attitudes of the user. Attitudes are modified by individual differences which can be classified into cognitive style, personality and demographic/situational variables. The demographic variables include age, experience and education (85:967).

Robey's (69) approach was to describe implementation problems with users by using behavioral science theory. He was particularly interested in the relationship between user attitudes and user behavior. To study this subject

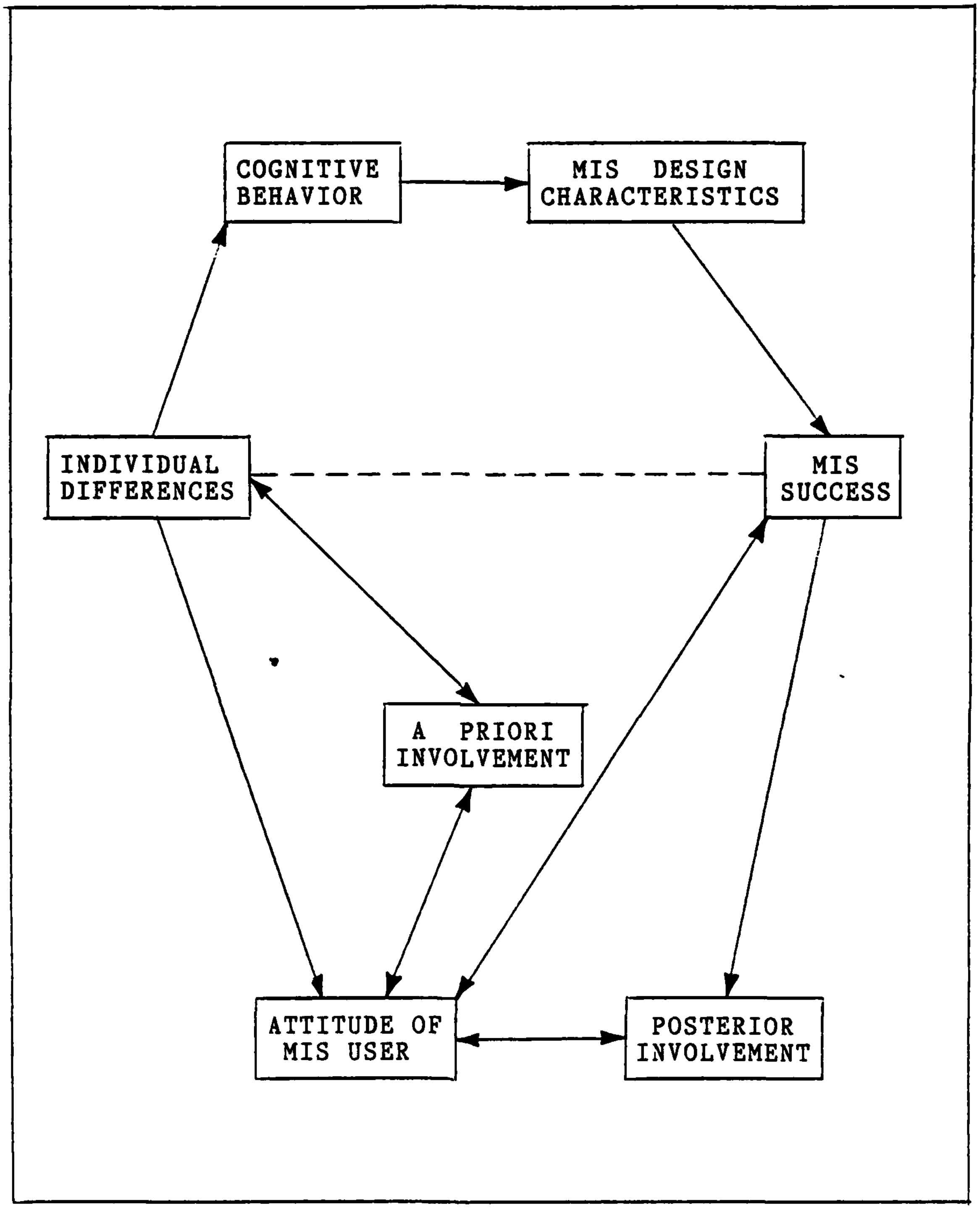

Figure 8. The Zmud Model of the Impact of Individual Differences upon MIS Success (reprinted from 85:967)

further he advanced the model depicted in Figure 9. The model is based on expectancy theory of motivation.

This model shows that use of the system is determined by a cognitive assessment by the user of various relationships. The user forms attitudes or perceptions concerning the following:

1. the value of rewards received from performance,
2. the probablility of rewards resulting from performance,
3. the probability that performance results from use (69:535).

The last component above is affected by system characteristics and user characteristics. Thus, job performance may decline in spite of extensive use if the system provides inaccurate information to the user. If this low performance results in lower job performance, users are likely to reduce their use of the system. Furthermore, the model implies that even if performance depends on use, use will not increase unless rewards are contingent upon performance.

While these models at least illustrate a positive influence of attitudes on MIS performance, one study by Schewe concluded that the affect of attitudes on individual behavior of using the system was nullified by other over-riding variables.

Schewe (75:577-590) focused his studies on the relationship between the perceptions by MIS users of their management information system, perceived variables

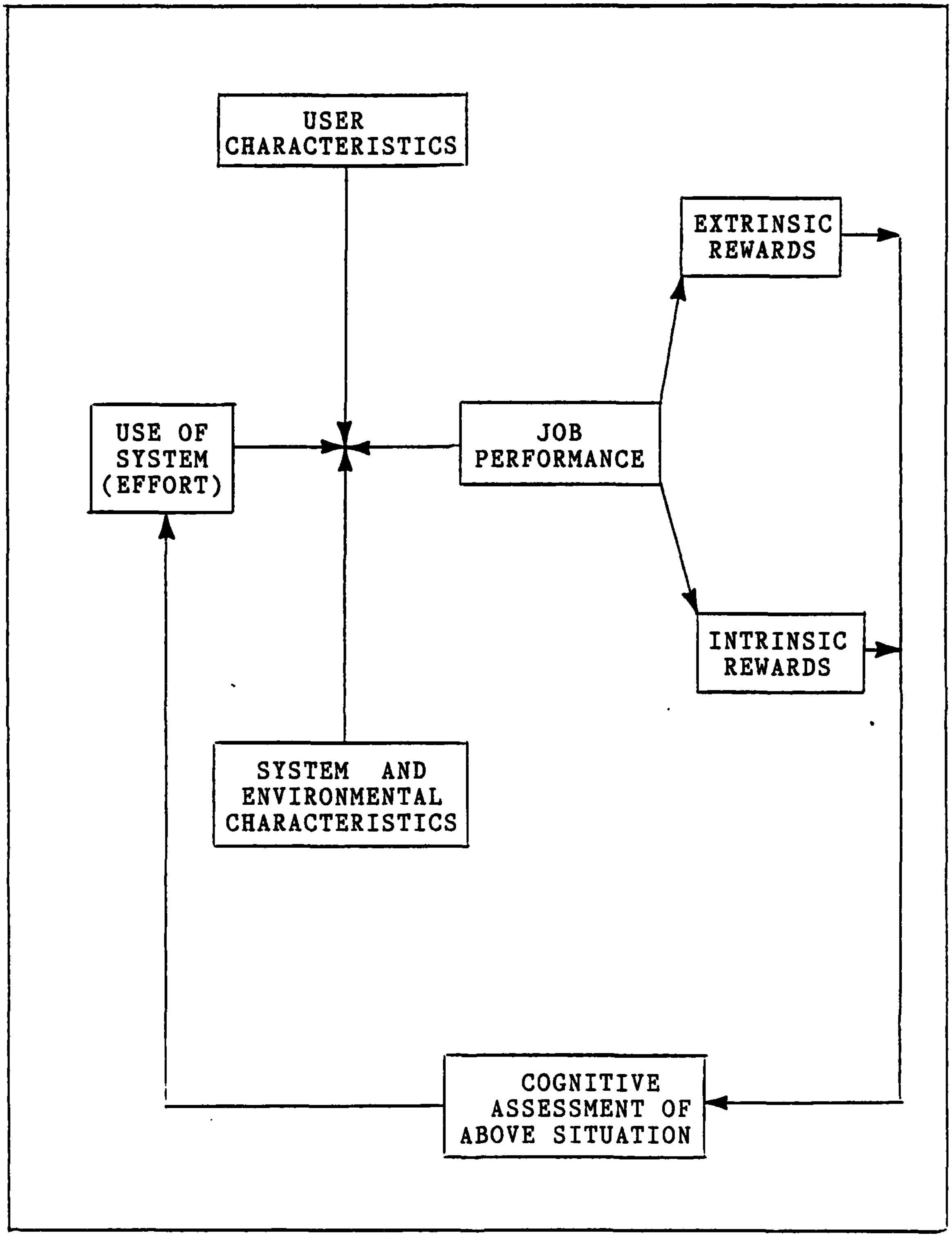

Figure 9. The Robey Model of User Behavior
(reprinted from 69:535)

exogenous to the system, attitudes and system usage. The model depicted in Figure 10 formed the basis of his study. In exploring the major determinants of a manager's request for information from their system (this being his operational definition of system usage), he concluded that no significant relationship exists between user attitudes and system usage behavior. Schewe validated his model by measuring the attitudes of a sample of marketing managers from ten food processing firms in three mid-western states. The results showed no significant relationship between attitudes and his operational definition of usage.

The rationale behind his theoretical conclusion that attitudes and usage are not significantly related was based on his model and empirical validation. The model shows that attitudes are formed from the user's evaluation of a set of beliefs in an object and about an object. It also depicts constraints that influence the relationship between attitudes and usage. These situational constraints intervene between attitudes and usage to such a degree that the relationship is over-riden. This effect can be illustrated by the case where a person may have a negative attitude toward the system but uses the management information system extensively only to please his superior.

Although Schewe's findings contradict the findings of other researchers (14:11; 58:146; 60:13,58; 61; 62; 69; 70; 71:70-78; 76; 81) in respect to attitudinal effects, one cannot conclude that no relationship exists. Furthermore

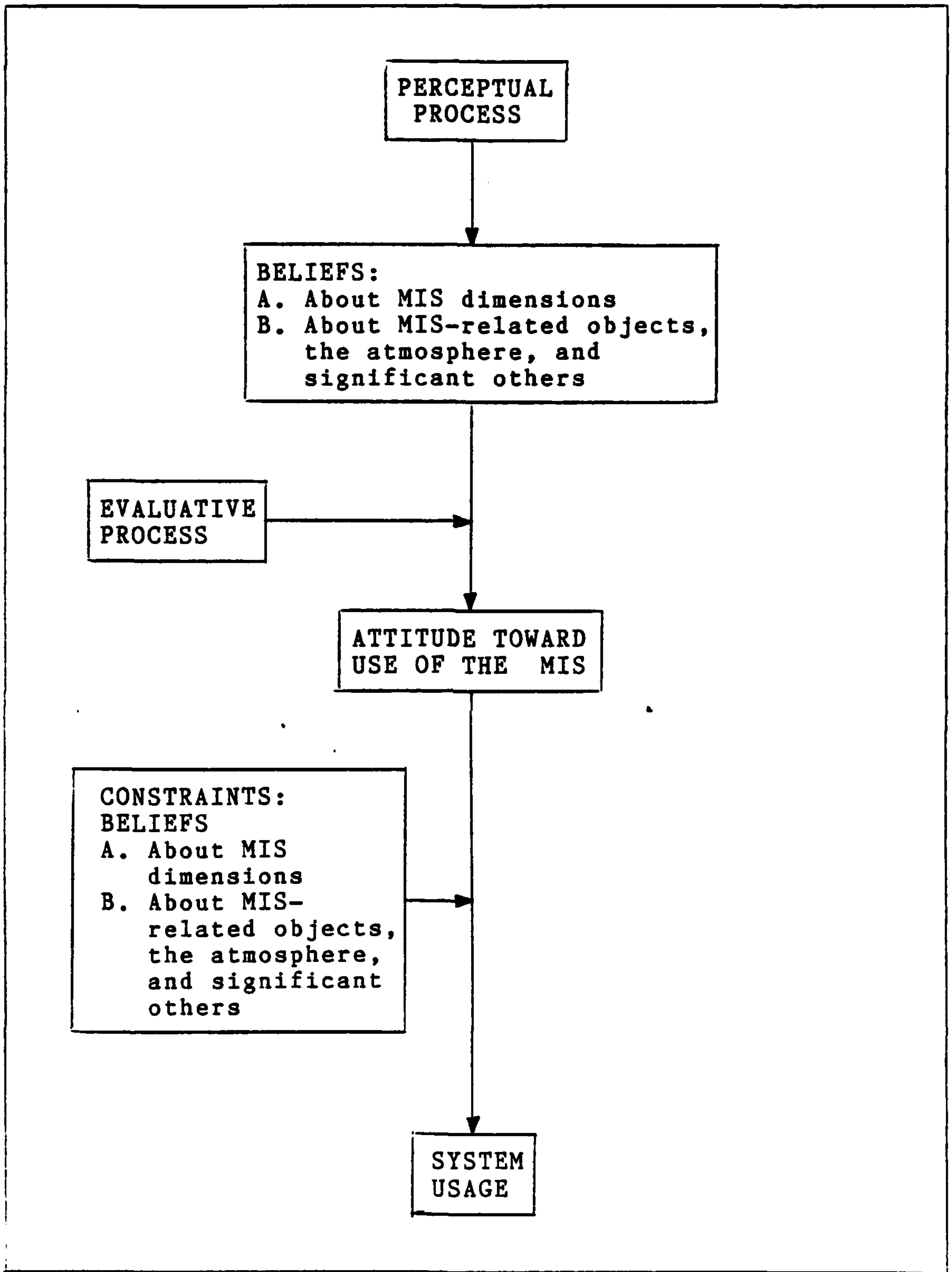

Figure 10. The Schewe Behavioral Model of System Usage (adapted from 75:578)

while Schewe and Robey addressed only usage in their models and not successful performance as well, their conclusion of the relationship between attitudes and usage does not necessarily imply that a similar relationship exists between attitudes and performance of the system. As revealed earlier in this literature review, usage is only a partial measure of system success and in some cases can be a poor indicator of success. Accordingly the conclusions drawn from these models is limited by the context of the variables defined in the models.

All of these models do have one thing in common which is the influence of user attitudes and situational and personal variables (e.g., location, age, education and experience) on individual behavior and performance of the management information system. The models also show that other variables interact with attitudes in influencing the behavior of the system. That, however, is where the similarities cease. Each model depicts a different relationship between attitudes, situational and personal variables and the successful performance of a management information system. Before reviewing empirical studies of these relationships, a closer review of the construct of attitudes is required. Then, these relationships are explored in greater depth.

Attitudes

The construct of attitudes has been defined in many ways, but most definitions capture key features as identified by Allport in his definition:

> A mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related [5:8].

He identified bi-polarity as the most distinctive feature of attitudes. An attitude "provokes behavior that is acquisitive or avertive, favorable or unfavorable, affirmative or negative toward the object or class of objects with which it is related" (5:8). Katzan also supports bi-polarity of attitudes. He states that

> people appear to be polarized: either they regard them computers and information systems as beneficial to mankind or they regard them as "terrible" machines that dehumanize and threaten the individual [53:307].

Allport's conceptualization of an attitude being a uni-dimensional continuum was challenged by Doob (80). He He argued that attitudes consisted of three components:

> an effective or feeling aspect, a cognitive aspect representing an individual's evaluation of or beliefs about an attitude object, and a conative aspect representing an action tendency toward the attitude object [80:24].

The same approach was adopted by Rosenberg and Hovland (74). They developed their idea on the basis of defining attitudes as "predispositions to respond in a particular way toward a specific class of objects" (74:1). As predispositions, attitudes could not, therefore, be

directly measured or observed. "Instead they are inferred from the way we react to particular stimuli" (74:1). Therefore, the stimuli form the attitude and the attitude determines the type of response. The types of responses can be used as indices of attitudes and were classified into three groups: cognitive, affective and behavioral. Figure 11 illustrates this conceptual idea.

The affective component is the emotion that inspires an idea in human thinking. Therefore, a person who feels bad about an object has a negative "affect". Conversely, a person who feels good about some object has a positive "affect" (83:3). Affect can be measured by using bodily reactions to a response. For example, the rise in blood pressure or galvanic response could be used as an indicator of affective response to a particular stimulus. However, it is more usual to seek verbal statements from the respondent about how much he or she likes or dislikes the stimulus (74:3).

Similarly, a simplifying procedure is normally adopted for measuring the behavioral component. The actual behavioral action in response to a particular stimulus could be measured directly, but it is more usual to make an inferrence from what the respondent says he or she would do if presented with the stimulus.

The cognitive component is the most difficult of the three to directly measure. It represents an idea used by humans in thinking (83:3). The usual method of measuring

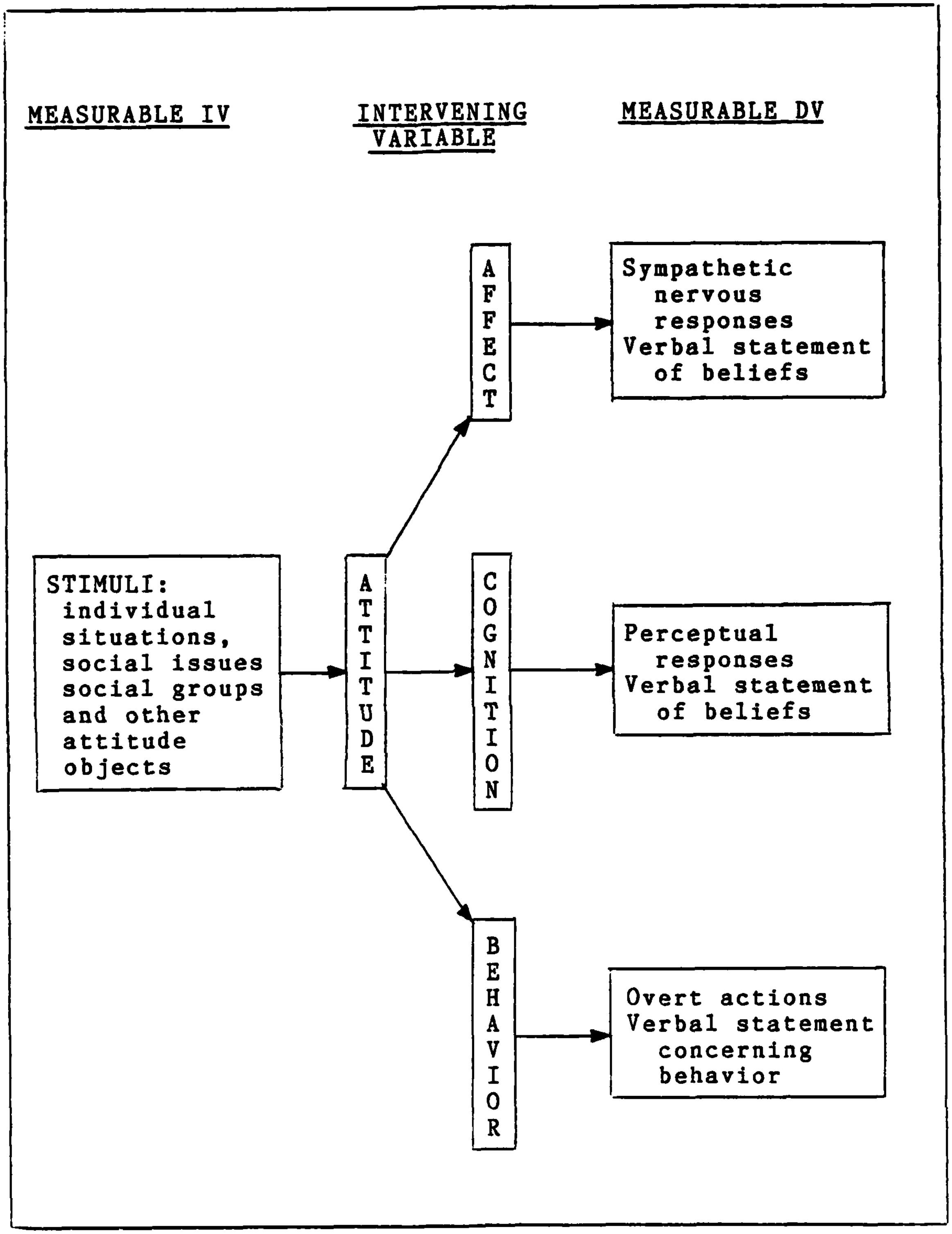

Figure 11. Schematic Conception of Attitudes (74:3)

this component is through the eliciting of beliefs, perceptions and concepts about an object using verbal or written communication.

The relationship between these components was addressed by Fishbein. Based on past research he concluded that attitudes (affect) are a function of beliefs (cognition) about an object and the evaluative aspects of those beliefs (38:480).

Fishbein also related attitudes (affect) to behavioral intentions (conation). Behavioral intentions can be described by five dimensions: admiration, friendship, social distance, subordination and superordination, and marital. Attitudes were found to be highly correlated to the first two of these dimensions and least correlated to the last of these dimensions (38:481). However, the correlation of attitudes and the total sum of these five dimensions was found to be quite high and stable (38:481-82). Finally, he concluded that both beliefs (cognition) and behavioral intentions (conation) are determinants or consequents of attitudes, rather than components of attitudes.

Whereas some theorists addressed affect, cognition and behavior as components of attitudes, Shaw and Wright chose to focus only on the affective component as a basis for their conception of the attitude construct. Attitudes were considered as an evaluative reaction to a stimulus "based upon cognitive processes" and formed "an antecedent of

behavior" (77:2-3). They identified six key dimensions of attitudes which provide a valuable basis for understanding this complex construct:

1. Attitudes are based upon evaluative concepts regarding characteristics of the referent object and give rise to motivated behavior.

2. Attitudes are construed as varying in quality and intensity (or strength) on a continuum from positive through neutral to negative.

3. Attitudes are learned, rather than being innate or a result of constitutional development and maturation.

4. Attitudes have specific social referents, or specific classes thereof.

5. Attitudes possess varying degrees of inter-relatedness to one another.

6. Attitudes are relatively stable and enduring.

The attitude variable is not the only one that affects behavior. Triandis states that no simple relationship exists between attitudes and behavior, but rather behavior is a function of four variables (83:14-16):

1. Attitude--how people would like to behave,

2. Norms--how people think they should behave,

3. Habits--how people usually behave,

4. Expectancies about reinforcement--the expected consequences of the behavior.

Despite the differences between them, all of the above conceptual ideas display two common features about the attitude variable with respect to its relationship with behavior. First, attitudes do not directly determine behavior but do have some influence. Second, other

variables besides attitudes that influence behavior exist. This does not mean that attitudes should not be studied. Triandis stated that "attitudes are worth studying; they are 'facilitating' causes not direct causes of behavior" (83:15-16). Furthermore, when norms, habits and expectancies are consistent, a consistent relationship between attitudes and behavior exists. However, when these variables are inconsistent, the relationship between attitudes and behavior becomes less consistent.

Relationship Between User Attitudes and Implementation Success

Of all the factors that may affect the success of a management information system, "user attitudes" was rated as the most important by 122 US corporations responding to a mailed questionnaire by Cerullo. Their view was that "users must have a positive attitude towards design, development and implementation of a new MIS" (14:11).

Most empirical studies of user attitudes have not only measured user attitudes but have also measured some performance variable for the system. Generally these performance variables have been user behavior, usage, perceived worth of the system or quality of the system.

In 1974, Lucas conducted a study of 117 administrators, batch process users and on-line users at a major university (62). The study consisted of surveying this sample by a questionnaire to determine the users' attitudes toward the quality of a computer-based system and

toward the quality of the services, the user's evaluation of the service, and the relationship of these attitudes with voluntary use of the system.

Step-wise regression of the data showed an association between actual quality of the system and quality as perceived by users, with favorable user attitudes. These favorable user attitudes and user evaluations were found to be positively associated with system usage. Lucas concluded that the value of these results enabled prediction of further increased use based on the presence of favorable attitudes (62:13).

Lucas also conducted a study of the successful implementation of an on-line computer-based planning model in a sample of firms (60). He found a strong relationship between user attitudes toward the model and successful implementation (use of the model) and contended that these two variables are key variables of the study. "Attitudes are good predictors of behavior so we expect to find favorable attitudes associated with high levels of interactive computer-based planning model use" (60:58). The most significant attitudes that correlated highly with successful implementation (use of the planning model) were favorable attitudes toward

1. the presence of few impediments to the use of the model,
2. good quality data-base,
3. model contribution,

4. perceived simplicity of model, and

5. ease of use of model.

A moderate relationship was found between general attitudes and perceptions and successful implementation. The general attitudes and perceptions that associate with successful implementation favored

1. management support for use of the computer model, and

2. quality of the in-house computer output.

Having a high quality in-house computer output appears to be not only associated with successful implementation but also with favorable attitudes as discussed earlier. Developing such an attitude among users would therefore appear to be a good preparation for a successful implementation effort.

In a later study of 400 account executives across the United States, Lucas found a strong relationship between use of a computerized investment model and user attitudes (58:146). "Use" was the dependent variable and was measured from reported use of the model and action taken based on the model by executives (58:144).

Schultz and Slevin (76) developed a Likert-type questionnaire to measure attitudes of management information system users. The questionnaire consisted of a large number of attitude statements which measured the attitudes of a sample of 94 management personnel in a large basic metals manufacturing company. The focus of the study

and of the attitudes that were measured related to a new computer forecasting model that was to be introduced to assist users in short-term forecasting of sales. The dependent variables consisted of intended use, perceived success, worth of the model and accuracy of the model. Factor analysis of the results yielded seven factors of significant concern to users during implementation of their system. These attitude factors are as follows:

1. Individual Job Performance--The effect of the system on the user's job performance and the visibility of this performance.

2. Interpersonal Relations--Interpersonal relations, communications, and increased interaction and consultation with others.

3. Organizational Changes--Changes that occur in the organizational structure and the people involved.

4. Clarity of Goals--Goals clarified, made acceptable to workers and more easily achieved.

5. Implementation Support--The implementation of the system has adequate support from top management, as well as technical and organizational support and is not resisted unduly.

6. Client/Researcher Relations--Researchers or the implementation staff understand management problems and work well with their clients.

7. Sense of Urgency--The perceived need for results in proportion to the costs; the importance of the results to the people involved.

The results of their study showed strong relationships between user attitudes and, respectively, worth and intended use. Correlation coefficients of 0.69 and 0.60 respectively were observed. Based on their findings, Schultz and Slevin provided some concluding recommendations

for future implementation efforts. First, they emphasized the importance of stressing personal benefits of the model to encourage users to use the model to help themselves and thus increase the likelihood of successful implementation. Second, top management support and goal congruence between organizational tasks and the model were also recommended as being important to the success of the model. Finally, relationships between users and the implementation staff should be maintained at an acceptable level to facilitate mutual understanding and cooperation.

Schultz and Slevin's instrument has been widely used and validated by other researchers. Rodriguez (73) used the instrument in a laboratory study on MBA students. The purpose of the study was to evaluate the effect of various implementation strategies on user attitudes and system use. He found that Attitude Factors 1 (job performance), 4 (goal clarity) and 7 (urgency of need) were positively related to the user's perceived worth of the system and their actual use of it.

Another study that used the Schultz and Slevin instrument was undertaken by Robey and Zeller (71:70-78) in 1978. Their study investigated managerial attitudes toward a quality control information system at two plants of a division of a large US corporation. The system had been accepted by one plant but rejected by the other. The results of the study showed that the adopting plant displayed more favorable attitudes for Factors 1 (job

performance) and 7 (urgency of need). Although the study did not identify causal relationships, it did identify that the two significant attitudes were related to the success of the system.

Robey and Bakr (70) used the same attitude-measuring instrument to study user attitudes of travel agency clerks with respect to individual differences in work values and with exposure time to a new system. As expected, those users with intrinsic work values initially accepted the system. As time elapsed, their attitudes deteriorated because of reduction in the scope of their tasks. Analysis of the data revealed that Factors 1 (job performance), 4 (goal clarity) and 7 (urgency of need) were significantly related with individual differences in work values and user exposure time to the system.

Robey (69) also used the Schultz and Slevin instrument in his study of 66 salesmen of an industrial products manufacturer. He sought "to relate the objective measures of system use to attitudes" (69:533). The results of the study displayed a strong relationship between Factor 1 (job performance) and the use variables. There was also a significant relationship with Factors 4 (goal clarity), 5 (support), 6 (research) and 7 (urgency).

The important conclusion that can be drawn from these studies is that the same three attitudes (job performance, goal clarity and sense of urgency) consistently varied significantly with the various performance measures and

implementation success. Although positive causal conclusions can not yet be drawn, the results do provide a basis to associate these attitudes with implementation success. Although the four other attitude factors did not display significant relationships, some minor associations were evident. Accordingly, retention of these factors in the instrument is necessary. Furthermore, the situational nature of the factors that influence the success of an MIS could cause these minor factors to become significant in certain situations. This provides grounds for searching for those situational and personal variables that could help explain more of the variation in success of management information systems. The effects of four of these variables on user attitudes and implementation success are to be discussed in this literature review. These variables are

1. the location of the user,
2. the age of the user,
3. the education of the user, and
4. the amount of previous experience a user has with computers.

The Effect of Location on User Attitudes and Implementation Success

In recent years, there has been a significant decentralization of computer support where organizations have shifted their ideas from the concept of centralized data systems to distributed data-base computer systems

(10:13-14; 72). Accordingly, greater latitude is now exercised by local managers in implementing information systems. More likely than not, each branch of an organization will differ in their implementation strategies. Therefore, studies over a range of implementation locations should be designed to detect local differences.

One such study was conducted by Roby and Zeller (70). A product quality information system had been implemented at two neighboring plants of a US manufacturing corporation. The plants produced a wide variety of high technology equipment for the health care industry. The information system was a success at one plant but a failure at the other plant. Data was collected using the Schultz and Slevin instrument on user attitudes to determine if the difference in implementation success could be explained. The results of their analysis showed that the plant that accepted the information system displayed more favorable attitudes than the other plant. Thus location of the user was an important factor in differentiating the data for exploring the observed differences in implemetation success.

The situational and personal factors of Lucas's models in Figures 6 and 7 include the variable location. Lucas conducted a study of 400 account executives across the US and found that user location (Northern, Southern, Mid-West and Eastern) significantly affected user attitudes towards

a computer-based model. The cause for the difference was attributed to different efforts of the model staff to increase local utilization of the model (58:149).

Therefore, for management information systems implemented at a variety of locations, it is important to evaluate implementation by location as well as overall. If an evaluation of a management information system at a number of locations only analyzes data as a whole for all locations, then isolated problems may be undetected or obscured by the weight of the data from other locations.

The Effect of Age on User Attitudes and Implementation Success

The situational and personal factors in Figures 6 and 7 include the variable for age of the user of a management information system. This is an important factor in predicting use; older people with set routines "are probably the least likely to use a new operations research model" (58:143). The reason for this is attributed to observations of older people having less positive attitudes than younger people (58; 63).

In a study conducted by Lucas (60) of the successful implementation of an on-line computer-based planning model, he found that "longer-term employees have less favorable attitudes toward the model" than shorter-term employees. Accordingly, he suggests that special attention be paid to the problems of more senior employees (60:54).

The opinions about the relationships between age of the user and user attitudes toward the system are mixed. Lucas found that older users had more positive attitudes toward model simplicity and ease of understanding but lower attitudes about the user interface. This could suggest that more experience by the user in an organization may enable the user to grasp the model more easily (60:54).

The study by Lucas found a relationship between age and successful implementation. He found a negative relationship between the number of years a user had with a firm and successful implementation as measured by use. In conclusion, Lucas states that "it appears that the least likely model user from an attitudinal or actual usage standpoint is the long-term employee of the firm" (60:61).

The Effect of Education on User Attitudes and Implementation Success

Very little empirical research has been conducted on the effect of a user's education level on his attitudes toward a management information system and on the success of the management information system. In general, less educated individuals have been observed to exhibit less positive attitudes (59). This relationship may not seem too surprising, but one empirical study of the relationship between education and success of a model (as measured by use) did yield surprising results. In the Lucas study of 400 account executives across the US, education was found to be negatively related to model use. This surprising

result was interpreted by the suggestion that perhaps the more educated executives experimented more with the computer model rather than using it (58:148).

The Effect of Previous Computer Experience on User Attitudes and Implementation Success

No literature was found to report on the effect of previous computer experience on user attitudes and implemetation success. Intuitively, one could expect a mixed relationship. On the one hand, if a user had extensive satisfactory experience with computers before a new management information system was introduced, one could expect to observe favorable user attitudes and a likely chance of successful implementation. On the other hand, a user who had bad experiences with a previous system could be expected to have many reservations about a new system and thus display negative attitudes and thus risk successful implementation.

Conclusion

This literature review aimed to explore the literature on user attitudes toward management information systems, on how the success of a management information system can be measured, on how user attitudes affect implementation success, and on how location, age, education and a user's previous computer experience affect user attitudes and success of a management information system. The Likert-scale instrument developed by Schultz and Slevin has

received wide use for measuring user attitudes and has been validated. In the absence of a better instrument, use of this instrument to measure user attitudes has prevailed.

The attitudes of significant concern to users during implementation involve

1. individual job performance,
2. interpersonal relations,
3. organizational changes,
4. clarity of goals,
5. implementation support,
6. client/researcher relations, and
7. sense of urgency.

Of these user concerns, job performance is the most important. Positive attitudes will develop if the system is seen by the user to improve his performance and visibility at work. Two other important concerns are goal clarity and urgency of need. The user will develop positive attitudes for these aspects if goals are made clear and achievable, and if the need for the system is understood. Positive attitudes are more likely to associate with a successful management information system, while negative attitudes are more likely to associate with an unsuccessful management information system. Finally implementation success of a system should be defined in terms of the goals of the system.

User attitudes have been theoretically and empirically found to be related to the success of management

information systems, although no direct or causal relationship could be determined. Of the many attitudes that exist, the ability of the system to improve job performance was found to be most important followed closely by goal clarity and urgency of need. Other attitude factors that may be related to implementation success include interpersonal relations, organizational change, implementation support and client/researcher relations.

Location, age, education and previous computer experience are situational and personal variables that can well affect user attitudes and successful implementation of a management information system. Empirical evidence exists to support the effect of location, age and education on user attitudes and implementation success.

III. Research Methodology

Overview

Chapter I identified the purpose of this study. The research questions are restated as follows:

Research Question 1

> What is the relationship between user attitudes and success of the Work Information Management System (WIMS) at major commands, separate operating agencies and the Air Staff?

Research Question 2

> How is the potential relationship between user attitudes and success of the Work Information Management System affected by the user's location (major command, separate operating agency or Air Staff), the user's age, the user's educational background and the user's previous experience with computers?

This chapter outlines the techniques that were used to answer the research questions. First, the philosophy behind the research design is presented. Then the population from which the sample was drawn is described. Next, the research questionnaire is discussed followed by the data collection plan. The next section explains the statistical tests used to analyze the data to answer the research questions. Finally, the assumptions and limitations of the research design are discussed.

Research Design

Before attempting to answer the research questions, the desired accuracy of the results were balanced against the

available resources. Whereas a complete explanation of the research findings could have been attained by collecting data from the entire population (i.e., census) and by using the most valid and reliable sampling techniques, the resources (e.g., time and funds) needed to collect such data would have been extremely high. Considering the remoteness of the population from the researchers and the limitations placed on funds and time, the researchers designed this study to maintain an acceptable balance between accuracy of results and economy of resources.

Population

The population for this study consists of all users of the Work Information Management System at the following locations:

1. Headquarters U.S. Air Force (HQ USAF), Pentagon DC;
2. Headquarters Air Force Reserve (HQ AFRES), Robins AFB GA;
3. Air Force Engineering and Services Center (AFESC), Tyndall AFB FL;
4. Alaskan Air Command (AAC), Elmendorf AFB AK;
5. Air Force Communications Command (AFCC), Scott AFB IL;
6. Air Force Logistics Command (AFLC), Wright-Patterson AFB OH;
7. Air Force Systems Command (AFSC), Andrews AFB MD;
8. Air Training Command (ATC), Randolph AFB TX;
9. Military Airlift Command (MAC), Scott AFB IL;
10. Pacific Air Forces (PACAF), Hickam AFB HI;

11. Strategic Air Command (SAC), Offutt AFB NE;

12. Space Command (SPACECOM), Peterson AFB CO;

13. Tactical Air Command (TAC), Langley AFB VA;

14. U.S. Air Forces in Europe (USAFE), Ramstein AB Germany;

15. AFRCE (Ballistic Missile Support), Norton AFB CA;

16. AFRCE (Central Region), Dallas TX;

17. AFRCE (Eastern Region), Atlanta GA;

18. AFRCE (United Kingdom), Ruislip AB U.K.; and

19. AFRCE (Western Region), San Francisco CA.

A WIMS user is defined as any individual who is assigned a WIMS User Identification Code. The number of WIMS users in the above organizations vary considerably, ranging from 19 at AFRCE (Ballistic Missile Support), to 331 at the Air Force Engineering and Services Center. The population consists of a combination of civilian and military professional engineers, architects, planners, trade supervisors, and clerical employees. Civilian grades range from GS-3 to GS-14 and GM-13 to GM-15. Military grades range from Airman to Chief Master Sergeant for the enlisted grades and from Second Lieutenant to Colonel for the officer grades. Although there are military personnel above the rank of Colonel who use WIMS, they have been excluded from the population because of protocol. The total population size is 2025. Since the population was too large for a census to be conducted within the limitations of time and budget, a sample was taken.

Sample Size

There were two factors considered in determining the appropriate sample size. Both relate to the statistical tests used to analyze the data. The first was the number of sample elements required to perform factor analysis, and the second was the number of sample elements required to perform regression analysis. The more restrictive of the two (i.e., the larger required sample size) was used as the criterion for determining the appropriate sample size in this research.

The major consideration in determining the appropriate sample size for factor analysis is that the sample be large enough to estimate the correlation coefficients reliably (82:379). Comrey (17) provides as a guide sample sizes of 50 as very poor, 100 as poor, 200 as fair, 300 as good, 500 as very good, and 1000 as excellent. Tabachnick suggests that if there are strong, reliable correlations and a few, distinct factors, a sample size of 50 may be adequate, as long as there are notably more cases than there are factors (82:379). This view is shared by Hair but "as a general rule there should be four or five times as many observations as there are variables to be analyzed" (45:219). This general rule was adopted for this study as the criterion for determining the appropriate sample size for factor analysis. With a maximum of 56 variables to be factored, the appropriate sample size would be four times the number of variables, or 224 observations.

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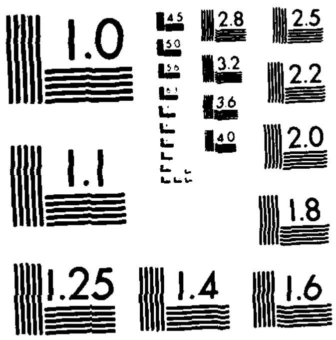

MICROCOPY RESOLUTION TEST CHART
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The second factor considered in determining the appropriate sample size was the number of sample elements required to perform regression analysis. Tabachnick (82:91-92) suggests that ideally, there should be 20 times more cases than independent variables. However, if stepwise regression is used in the research, a more appropriate ratio would be 40 to 1. The suggested minimum sample size is 4 to 5 times more cases than independent variables. In this research, the maximum number of independent variables that was used in regression analysis was 29 (7 possible independent variables measuring attitude, 19 separate dichotomous independent variables specifying the location, and 3 demographic variables specifying education level, computer experience, and age). Using the suggested minimum requirement of 5 times more cases than independent variables, the minimum appropriate sample size for regression analysis is 145.

Since the sample size of 224 needed to perform the factor analysis was the more restrictive of the two, it was used as the criterion for selecting the sample size for this research. To insure that at least 224 valid observations were obtained, 400 questionnaires were distributed. This represents an expected return rate of 60 percent, plus an allowance (26 additional observations) for returned questionnaires which could not be used (e.g., mismarked, incomplete). The researchers felt a 60 sixty percent return rate was a reasonable expectation because the survey was

administered personally by the WIMS Administrators at each location. This procedure allowed for more controlled distribution and collection of the questionnaires.

Sampling Technique

The sample was taken using a proportionate stratified sampling technique. There were two major reasons for choosing this type of sampling technique. The first was to increase the entire sample's statistical efficiency. Since the sampling is effectively performed at random from a set of subpopulations, the calculation of sampling errors can be considered to be carried out for each subpopulation independently. In this way, the between-strata variances never enter into the calculations of sampling errors. That is, the sampling error values do not have to take into account the proportions of the various strata in the sample compared with those proportions to be expected in the total population (79:30-32).

The second reason for using proportionate stratified sampling was to insure that each of the subdivisions of the population was adequately and equally represented in the sample. If a simple random sampling technique was used, there would be a risk of not obtaining any observations from the smaller subdivisions.

The population was divided into 19 mutually exclusive subpopulations, or strata, according to location. A simple random sample using a random number table was then taken

TABLE III

Sample Size Proportion and Sample Size, By Stratum

STRATUM	POPULATION SIZE (a)	RELATIVE WEIGHT (b)	SAMPLE SIZE (a x b)
AAC	51	0.03	12
AFCC	20	0.01	4
AFLC	117	0.06	24
AFRCE(BMS)	19	0.01	4
AFRCE(CR)	40	0.02	8
AFRCE(ER)	38	0.02	8
AFRCE(UK)	35	0.02	8
AFRCE(WR)	38	0.02	8
AFSC	54	0.03	12
ATC	106	0.05	20
HQ AFESC	331	0.16	64
HQ AFRES	53	0.03	12
HQ USAF	226	0.11	44
MAC	110	0.05	20
PACAF	112	0.05	20
SAC	207	0.10	40
SPACECOM	63	0.03	12
TAC	178	0.09	36
USAFE	227	0.11	44
TOTALS	2,025	1.00	400

from each of the stratum. The sample size for each stratum was in proportion to the stratum's share of the total population. Table III shows each of the stratum with its respective sample size proportion and sample size. The sampling frame from which the actual sample was selected consisted of complete and current lists of WIMS users, by name, which were provided by the WIMS administrators at each of the locations.

Justification of Survey Approach

After determining the sample size and composition, the next step was to determine the appropriate method of collecting the data. Because of the remote and diverse locations of the population (i.e., Hawaii, Alaska, 16 CONUS states, United Kingdom, and Germany), the researchers chose a survey as the method of data collection. A mailed questionnaire was the only practical and economical method to gather data.

Personal interviews were considered as a data collection method. This method may have produced more detailed and reliable data due to better control over the interviewing conditions. However, limitations in time and budget precluded using this data collection technique.

Telephone interviewing was also considered as a means to collect the necessary data. However, because of the inherent difficulty in controlling the interviewing conditions, this method could result in unreliable data. For this reason, the researchers chose not to use telephone interviewing.

Data Collection Plan

The data collection plan consisted of selecting the most appropriate method of data collection, selecting the instrument, evaluating the validity and reliability of the

instrument, and acknowledging assumptions and limitations of the data collection plan.

Research Questionnaire

The questionnaire (Appendix A) was divided into three parts: demographic details, perceptions concerning success of WIMS, and attitudes concerning WIMS.

The demographic details sought in the first part of the questionnaire were:

1. work location,
2. education level,
3. computer experience prior to WIMS,
4. years of USAF service, and
5. age of user.

The questions were structured for multiple choice, categorical responses. The question pertaining to years of USAF experience was inserted into the questionnaire at the recommendation of USAF Manpower Personnel Center, the approval authority for the questionnaire; however, it was not used in the data analysis.

The second part of the questionnaire asked for the respondent's evaluation of WIMS' success. Since there was no existing standard measurement instrument available to measure the success of WIMS, questions were developed by the researchers based on the Air Force's objectives for the MAJCOM and AFRCE WIMS. The basis for this approach was established by the literature review in Chapter II. Thus,

the success of WIMS could be measured by the degree to which WIMS met its objectives.

The researchers used a USAF document called the Projected Automation Requirement (PAR) for the Work Information Management System (20) to define the objectives of WIMS. The PAR was the proposal for the establishment of the MAJCOM and AFRCE WIMS and was the basis for the approval of the project (16). The PAR is of sufficient official value to use for defining the objectives of WIMS. The following quote from the PAR is the basis for defining the objectives of WIMS for the purposes of this research:

> The Major Command WIMS will improve data availability, resulting in more timely and more informed decisions within major command Engineering and Services and AFRCEs. It will lessen the need for manual data reductions, improve the response time and decrease the probability of incorrect *decisions* made using incomplete information. The system will be part of a "total" Engineering and Services functional network, linking bases to MAJCOMs and MAJCOMs and AFRCEs to HQ USAF/LEE and HQ AFESC. This will provide improved data flow, reduced administrative time in preparing reports, and reduction in duplicate data storage. It will improve productivity of Air Force personnel and minimize information burden on users, providers, and handlers, thereby reducing the costs, labor and intensiveness, and time acquiring, processing, delivering and using information in the workplace. The WIMS will enhance the credibility of the Engineering and Services staffs to make instantaneous mission essential management decisions [20:2].

The above quote provided the basis for framing eight of the nine questions in Part II of the questionnaire. The intent in developing these questions was to capture the major points of the PAR as described in the quote. Since each of the objectives relate to some aspect or

characteristic of the user's work, eight questions were developed to measure the respondent's perception of how WIMS has changed these aspects or characteristics of his or her work. These questions (numbered 7 to 14 in the questionnaire) are as follows:

1. Has WIMS changed your productivity?
2. Has WIMS changed your accuracy in decision-making?
3. Has WIMS changed your response time for making decisions?
4. Has WIMS changed the amount of information you use in your decision-making?
5. Has WIMS changed the amount of time you spend in preparing reports?
6. Has WIMS changed the amount of time you spend in reducing (consolidating) data?
7. Has WIMS changed the availability of information that you need to do your job?
8. Has WIMS changed the speed at which you circulate information in your work?

These questions used a seven-point Likert-type scale for the responses with "1" representing the least change, "7" representing the most change, and "4" representing no change.

A ninth question (number 15 in the questionnaire) was also used to measure the respondent's perception of the overall success of WIMS. This question used a seven-point Likert-type scale for the responses, with "1" representing the greatest degree of failure, "7" representing the greatest degree of success, and "4" representing no change.

Respondents were also invited to amplify their responses in writing if they wished.

The third part of the questionnaire asked for the respondent's opinions toward various aspects of WIMS. This section was adapted from the Schultz and Slevin questionnaire which was developed to measure attitudes of management information system users (76). Their questionnaire consists of 56 statements about various aspects of a management information system. Each of the statements was revised by the researchers in two ways. The first was in tense. Whereas the statements in the Schultz and Slevin questionnaire were expressed in the future tense, the statements used in this research questionnaire were expressed in the present tense. The second revision was that the term "WIMS" was substituted wherever the term "Forecast" was used. "Forecast" was the name of the MIS being studied. No other changes were made to the statements. The statements use a five-point Likert-type scale for the responses, with "1" representing the strongest disagreement, "5" representing the strongest agreement, and "3" representing uncertainty.

Variables Isolated. The questionnaire was specifically structured around the variables isolated in the research questions. Research Question 1 reflects two variables of interest. The first is the dependent variable--success of WIMS. The questions contained in Part II of the questionnaire measure this variable. The second variable of

interest is actually the set of independent variables--user attitudes. The statements contained in Part III of the questionnaire measure this set of variables. Research Question 2 reflects four more variables of interest--location, education level, prior computer experience, and age. Part I of the questionnaire measures these variables.

Validation of Part I of the Questionnaire. Part I of the questionnaire needs no validation since it measures simple facts which could not be misinterpreted in any way.

Validation of Part II of the Questionnaire. Validation of Part II of the questionnaire was achieved by pretesting the questions and factor analyzing the responses to the final questions. Part II was pretested prior to administering the final survey by administering it to 24 AFIT students in the Graduate Engineering Management program. All of these students were Air Force civil engineering officers, with the exception of one Marine civil engineering officer, ranging in rank from First Lieutenant to Major. These students were asked to answer the questions and to critique their content and structure. Based on an analysis of the pretest responses and the recommendations pertaining to content and structure, ambiguities were removed and the questions were revised. The revised questions were then used in the final questionnaire. Factor analysis was used on the actual survey responses to Part II to validate

whether all of the questions measured the same variable--success of WIMS.

Validation of Part III of the Questionnaire. The Schultz and Slevin instrument, which was used as the basis for Part III of the questionnaire in this research, has been widely used and validated in studies by other researchers. As reported in the literature review of Chapter II, the Schultz and Slevin instrument was tested initially by Schultz and Slevin (76). Since then, it has also been empiricaly tested by Robey (69), Robey and Bakr (70), Robey and Zeller (71), and Rodriguez (73). These studies have yielded significantly valid, reliable and consistent results. For this reason, the instrument was considered to be valid for the purposes of this research without the need for further testing. Nevertheless, in the interest of valid research analysis, the researchers considered it necessary to replicate the factor analysis of the attitudinal responses. Such factor analysis by Schultz and Slevin had yielded seven underlying dimensions of attitudes--individual job performance, interpersonal relations, organizational changes, goal clarity, implementation support, client/researchers relations, and sense of urgency (76). A full discussion of the factor analysis is provided in the Statistical Analysis section of this chapter.

Reliability of Questionnaire. The reliability of an instrument reflects the degree to which the results are free from error. Of the several methods available to assess the

reliability of an instrument, the internal consistency method was selected for this study. This method assesses the degree to which the questions associated with a particular factor are homogeneous (78). In this study, there are several factors measuring the attitudes of WIMS users and one factor measuring the perceived success of WIMS. Cronbach's coefficient alpha was used to estimate the internal consistency of the questions in each factor. The coefficient alpha ranges from zero to one and sets the upper limit to the measure of reliability. If the coefficient alpha is low, then the items within the factor have little in common (67). If the value is near 1.0, then the items within the factor are strongly related. A full discussion of the reliability analysis is provided in the Statistical Analysis section of this chapter.

Details of Collection

After the random sample was taken and the specific sample cases were known (by name and organization), the researchers sent the questionnaires to the WIMS Systems Administrators at each location. The Administrators were asked to distributute the questionnaires to each of the participating individuals in their organization and then to collect them within a specified period and mail them back to the researchers. In this way, the administration of the survey was more controlled than if the questionnaire

had been sent individually to each person. The survey was conducted during the period of June to July 1984.

Statistical Analyses

This section describes the data analysis techniques used to validate the instrument and to answer the two research questions. The techniques used to validate the instrument consist of factor and reliability analysis. Bivariate and multiple regression analysis were then used to analyze the data and answer the research questions. Before explaining the statistical tests used in the research, it is important to discuss the assumption made concerning the data level. The statistical tests performed on the data assumed at least interval-level data. However, the data in reality can only be considered ordinal-level since Likert-type scales were used. There has been some controversy among researchers as to the appropriateness of using Likert-type scales in statistical tests that require interval-level data as a minimum (39:46). In recent years many researchers have begun to accept the use of ordinal-level data if the data at least approximates the interval scale. Gardner suggests that the distinction between ordinal scales and interval scales is not sharp. He states that "many summated scales yield scores that, although not strictly of interval strength, are only mildly distorted versions of an interval scale" (39:55). Bohrnstedt explains that the major concern when one assumes

interval-level measurement where only ordinal measurement exists, is that some measurement errors will occur. Generally, however, the result of these type of measurement errors is the attenuation of the relationship among variables. Thus, the apparent relationships that are found among variables during the research will likely be more attenuated than they are in reality (12:82). The possibility of attenuation of the relationships among variables was, therefore, taken into consideration in the analysis of the results of the statistical tests.

Factor analysis refers to a variety of statistical techniques which have as a common objective to represent an initial set of variables in terms of a smaller set of hypothetical variables, hereafter called factors (56:9). In this research study, a questionnaire consisting of 71 questions was used--6 questions concerning demographic information, 9 questions measuring perceived success of WIMS, and 56 questions measuring user attitudes. Since the questions dealing with perceived success of WIMS and user attitudes were not all identical, they do not measure the basic underlying dimensions to the same extent. By using factor analysis, the researchers were able to identify the separate dimensions being measured by the survey (45:218). The specific goals of factor analysis in this research were as follows (82:372):

1. To summarize the patterns of intercorrelations among the questions in each of the sets of

questions contained in Parts II and III of the questionnaire.

2. To reduce the large number of questions in each set of questions contained in Parts II and III of the questionnaire to a smaller number of more meaningful dimensions or factors.

The first step in factor analysis is the calculation of the interrelationships (correlations) among the questions in each set (56:9). The correlation coefficients are based on the correlations between variables (R-factor analysis) as opposed to correlations between individual cases (Q-factor analysis) (66:470). The correlation coefficients indicate which of the various questions hold positive relationships with other questions.

The second step is determining whether these observed correlations could be explained by the existence of a small number of hypothetical dimensions or factors within the set of questions (56:9). Principal-component analysis was the specific approach used in this study. This statistical approach constructs a set of new factors, also called components, on the basis of the interrelationships exhibited in the data. In this way, the new factors may be defined as exact mathematical transformations of the original data. The initial sets of new factors are extracted in such a way that each factor is independent from the others; that is, they are orthogonal (66:470). The first principal factor is considered the single best summary of linear relationships exhibited in the data. The second factor is defined as the best linear combination of variables, given that the second

factor is orthogonal to the first. That is, the second factor must account for the proportion of the variance that is not accounted for by the first one. In this way, the second factor can be defined as the linear combination of variables that accounts for the most residual variance after the effect of the first factor is removed from the data. Subsequent factors are defined in the same manner until all of the variance in the data has been explained (66:470).

The final step in factor analysis is orthogonal rotation of the factors to achieve the best "fit" of factors with the data. In this way, some of the variables will fit, or load, more heavily on the first factor, while others will load more heavily on the second factor, and so on. This condition suggests that there are rather "pure" constructs underlying each of the factors (36:451).

The subprogram FACTOR in the Statistical Package for the Social Sciences (SPSS) (66:468-514) was used to perform the factor analysis. The program output of concern in this research consisted of factor loadings, communalities, and percent of total variance explained by the set of factors.

"A factor loading represents the correlation between an original variable and its respective factor" (45:234); thus, there is a factor loading value for each combination of variable and factor. Factor loadings range in value from -1.0 to +1.0. The larger the absolute size of the factor loading the more significant the correlation between the variable and the factor. This value, when squared,

represents the amount of variance that the variable has in common with the factor. As a rule of thumb, used frequently by factor analysts as a means of evaluating factor loadings, absolute factor loadings greater than 0.3 are considered significant, absolute loadings greater than 0.4 are considered more important, and absolute loadings greater then 0.5 are considered very significant. When compared with other criteria this approach, according to Hair, is quite rigorous and acceptable (45:234). The researchers used 0.3 as the minimum absolute factor loading for determining whether a variable should be included in the study. Variables that did not load on any factor with an absolute loading greater than or equal to 0.3 were eliminated from the study.

Each variable also has a communality value which represents the amount of variance in that variable that is explained by the set of factors. This value ranges from 0 to 1.0. Large communalities indicate that a large amount of the variance in the variable is being explained by the set of factors. Small communalities indicate that a substantial portion of the variance in the variable is unaccounted for by the set of factors. A communality value greater than 0.25 indicates a significant amount of variance in the variable is being explained by the set of factors (45). In this analysis, variables with communalities less than 0.25 were eliminated from the study.

The total amount of variance in the data explained by the set of factors is one of the common criteria used to determine the number of significant factors. A complete set of factors would account for all of the variance in the data. However, because this results in a set of factors which is usually as large as the set of variables from which it was derived, a practical limit must be placed on the amount of total variance to be explained by the set of factors. Hair reports that when using social science data it is common for the analyst to consider a solution which accounts for 60 percent of the total variance in the data as a satisfactory solution (45:232). This was the criterion used in this study to determine the number of factors in the final solution.

After the factor solution was determined, reliability analysis was performed to evaluate the internal consistency of the data. Reliability refers to "how accurate, on the average, the estimate of the true score is in a population of objects to be measured" (66:248). A low reliability coefficient means that a substantial portion of the variance in the observed scores is due to measurement error. On the other hand, a high reliability coefficient means that there is little measurement error. Cronbach's coefficient alpha was the specific measure of reliability used in this study. Cronbach's coefficient alpha ranges in value from 0 to 1.0. The subprogram RELIABILITY of SPSS (50:248-267) was used to calculate the coefficient.

Regression analysis is a statistical technique which is used to evaluate the relationship between a dependent variable and one or more independent variables (82:86). The specific purpose of regression analysis (bivariate and multiple) is to "examine the strength of association between the single dependent variable and the one or more independent variables" (45:36).

In this research, several potential relationships were analyzed. They are as follows:

1. The relationship between the success of WIMS and the combined set of factors measuring attitudes of WIMS users; the analysis of this relationship revealed which of the attitude factors as a combined set of variables were significant predictors of success.

2. The relationship between the success of WIMS and each of the demographic variables; the analysis of this relationship revealed which of the demographic variables (individually) were significant predictors of success.

3. The relationship between each of the significant attitude factors and each of the demographic variables; the analysis of these relationships revealed which of the demographic variables (individually) were significant predictors of each of the significant attitude factors.

The dependent variables of interest in this study were defined as follows:

1. The perceived success of WIMS.

2. Each of the factors measuring attitudes which proved to be significant predictors of perceived success of WIMS.

Perceived success of WIMS was calculated by using the set of questions from Part II of the questionnaire. Through factor and reliability analysis, the researchers determined

which of the questions, used as a combined set, measured most accurately the perceived success of WIMS. The responses to these questions were then averaged to come up with the value of perceived success.

The independent variables of interest in this study were defined as follows:

1. Each of the attitude factors, as determined by the factor analysis.

2. Each of the demographic variables, as calculated using the information gathered from Part I of the questionnaire (user location, education level, computer experience, and age).

In order to fully explore the effects of the demographics on both perceived success of WIMS and each of the attitude factors, each of the demographic questions was divided into separate variables, with each of the variables representing a particular group or category. These dichotomous variables were created by recoding the responses to each of the questions so that the value of one was recorded if the response fit into the category and the value of zero was recorded if the response did not fit into the category. The following variables were created using this technique:

1. Each separate Headquarters, AFRCE, and MAJCOM.

2. Persons with at least some college.

3. Persons with at least a Bachelor's degree.

4. Persons with at least a Master's degree.

5. Persons with a doctoral degree.

6. Persons with more than 6 months computer experience.

7. Persons with more than 1 year computer experience.

8. Persons over 25 years old.

9. Persons over 30 years old.

10. Persons over 35 years old.

11. Persons over 40 years old.

12. Persons over 45 years old.

13. Persons over 50 years old.

Since many of the above new variables were not mutually exclusive, each was used separately and individually in the statistical analyses. In this way, none of the results of the analyses were confounded.

Multiple linear regression was used to first determine which combination of attitude factors (if any) is a statisticaly significant predictor of the perceived success of WIMS. This relationship was then further analyzed to evaluate the individual contribution of each of the attitude factors. The subprogram NEW REGRESSION in SPSS (50:94-121) was used to conduct these statistical analyses.

Bivariate or simple linear regression analysis was then used to determine 1) which of the demographic variables are statistically significant predictors of perceived success of WIMS, and 2) which of the demographic variables are statistically significant predictors of each of the attitude factor which proved to be significantlly related

to perceived success of WIMS. The subprogram NEW REGRESSION was again used to conduct these analyses.

The program outputs of NEW REGRESSION that were used in the statistical analyses included the Pearson product-moment correlation coefficient (r), the coefficient of determination (R-squared), the change in R-squared, the standardized regression coefficient (beta), and the F-change significance. Each of these are explained below.

The Pearson Correlation Coefficient (r) is a measure of the correlation between the dependent variable and a single independent variable. This value, when squared, represents the proportion of variance in the dependent variable that is explained by the independent variable (66:301-304).

The coefficient of determination, or R-Squared, represents the proportion of variation in the dependent variable that is explained by the independent variables which are in the regression equation (66:324-325).

The change in R-squared represents the additional or incremental proportion of variation in the dependent variable that is explained by the incoming independent variable, given that the other independent variables in the equation are already accounted for (66:334-340).

The standardized regression coefficient, or beta, is a standardized coefficient which allows one to compare the relative effect on the dependent variable of each independent variable regardless of the original raw value units. This value is a product of the unstandardized

regression coefficient and the ratio of the standard deviation of the independent variable to the standard deviation of the dependent variable (66:325). The unstandardized regression coefficient is simply the slope of the regression line and indicates the expected change in the dependent variable with a change in one unit of the independent variable (66:323). The value of the standardized regression coefficient in this study is in evaluating the relative effect (positive or negative) of the independent variable on the dependent variable.

The F-change significance represents the level of significance of the F-ratio test. This test indicates whether the sample of observations that is being analyzed has been drawn from a population in which the multiple correlation between the dependent and the incoming independent variable is equal to zero, and that any observed correlation is due to measurement or sampling error (66:335). A 95 percent level of significance was used in this research.

Assumptions

The following assumptions were made by the researchers pertaining to the statistical techniques used in this study:

1. Each array of values for the dependent variable for a given combination of independent variables follows the normal distribution.

2. The regression line of the dependent variable and the independent variables is linear.

3. All of the arrays of values for the dependent variable have the same variance.

4. The level of data used was at least interval scale.

Possible violations of the first three assumptions above were evaluated through a direct examination of residuals. The numerical value of a residual is the difference between the predicted value of the dependent variable using the regression equation and the actual value of the dependent variable. The residuals were plotted against the predicted value of the dependent variables using the SCATTERPLOT option in NEW REGRESSION (Hull:112-114). The important feature evaluated in the scatterplots was the overall pattern. If there appeared to be no particular pattern to the scatterplots, then the assumptions were accepted as correct (Nie:342).

In addition to the assumptions made for the statistical tests, the following assumptions were made by the researchers:

1. The questions derived from the PAR for measuring the perceived success of WIMS are appropriate measures of success of WIMS.

2. The population of WIMS users is realistically represented by those persons with a user ID.

3. The survey resondents answered the questionnaire candidly and marked the answer sheets correctly.

4. At least 60 percent of the questionnaires would be returned to the reseachers.

5. A 95 percent level of significance would provide sufficient accuracy for the purposes of this study and the possible uses of the conclusions.

Limitations

A major limitation in this research, as with most behavioral research, was the lack of a means to objectively measure success of WIMS. The responses to the questions which dealt with success of WIMS were based solely on the personal perceptions and opinions of the respondents.

Another limitation was that only limited accuracy could be expected in the measurement of attitudes. That is, attitude measurement is a behavioral science concept and is not easily quantified. Factors such as misinterpretation of questions in the questionnaire, local environmental conditions, and the health and personalities of the respondents could effect the accuracy of the measurement of attitudes.

Finally, in a cross-sectional study such as this was, no causality could be inferred from the data. Causality can best be determined by administering a longitudinal study.

IV. Findings and Analysis

Overview

This chapter describes the findings of the survey and analyzes the data to validate the questionnaire and to answer the research questions. The survey findings are presented first in which the characteristics of the data are described. Then the survey findings are statistically analyzed as follows:

1. The responses to Part II questions are factor analyzed to determine whether the questions do measure WIMS success. Cronbach's coefficient alpha is then calculated to determine the reliability of the "WIMS success" factor constructed from these questions.

2. The responses to Part III questions are factor analyzed to determine whether the questions do measure some smaller set of attitude factors. Cronbach's coefficients are then calculated to determine the reliability of the attitude factors.

3. Regression analysis is used to evaluate the relationship between WIMS success and the attitude factors and between WIMS success and each of the demographic variables. Then, each significant attitude factor is analyzed to determine how each demographic variable is related to it.

Survey Response Rate

Four hundred questionnaires were distributed between Headquarters United States Air Force, Headquarters Air Force Reserve, Air Force Engineering and Services Center, eleven Major Commands (MAJCOM), and five Air Force Regional Civil Engineer (AFRCE) offices. A total of 315 questionnaires were answered and returned, which represents

a total response rate of 79 percent. However, of the 315 responses, 53 were non-usable. The problem with the non-usable responses was predominantly one of incomplete responses, in which Part II and/or Part III of the questionnaire were not answered. Sixteen respondents actually took the time to write to the researchers explaining either that they had never heard of WIMS, that they did not know why it was in their organization, or that they just did not use it. Incorrect coding of questionnaire responses on the respondents' computer answer sheets accounted for only 2 of the 53 non-usable reponses.

Eliminating the 53 non-usable responses from the total of 315 responses yielded 262 usable responses. This represents an effective return rate of 66 percent of the 400 questionnaires. It also exceeds the minimum number of responses (i.e., 224) required to satisfy the statistical criteria described in Chapter III.

Table IV provides a breakdown of the usable responses by location. Headquarters United States Air Force, the Air Force Engineering and Services Center and both overseas organizations (i.e., United States Air Forces in Europe, and AFRCE (United Kingdom)) demonstrated poor response rates. At the other extreme, excellent response rates were received from Strategic Air Command, Pacific Air Forces, Military Airlift Command, Air Training Command, Air Force Systems Command, Alaskan Air Command, and CONUS AFRCEs. All other response rates were good.

TABLE IV

Comparison of the Number of Questionnaires Distributed and the Number of Usable Responses Received

Organization	Sample Size	Usable Responses Received	Actual Response Rate (%)
Air Force Engineering and Services Center	64	27	42
United States Air Forces in Europe	44	19	43
Headquarters United States Air Force	44	20	45
Strategic Air Command	40	35	88
Tactical Air Command	36	21	58
Air Force Logistics Command	24	17	71
Pacific Air Forces	20	19	95
Military Airlift Command	20	18	90
Air Training Command	20	16	80
Space Command	12	8	67
Air Force Systems Command	12	8	67
Headquarters Air Force Reserve	12	7	58
Alaskan Air Command	12	9	75
AFRCE (Central Region)	8	8	100
AFRCE (Eastern Region)	8	8	100
AFRCE (Western Region)	8	7	88
AFRCE (United Kingdom)	8	4	50
Air Force Communications Command	4	3	75
AFRCE (Ballistic Missile Support)	4	3	75
Unspecified location		4	
Total	400	262	66

Although 262 cases (usable responses) were available for use, some cases contained missing data (i.e., an occasional unanswered question). In each statistical test, missing data was deleted listwise; that is, the entire case

was deleted from the analysis if any of the variables being analyzed had a missing response. Therefore, the statistical analyses report varying numbers of cases.

Data Characteristics

The questionnaire (Appendix A) consisted of 71 questions, sub-divided into three parts. The first part contained the demographic questions (1 to 6). The second part contained nine questions (7 to 15) that measured the respondents' perception of the success of WIMS. The third part of the questionnaire contained 56 statements (16 to 71) on the respondents' attitudes toward WIMS. Appendix B contains the raw data collected from the 262 respondents. The entries in the raw data file were recoded to add one unit to each entry (i.e., 0=1, 1=2, 2=3, etc). The characteristics of the data are summarized in the following paragraphs.

Location. Respondents to the questionnaire were geographically located at 19 different organizations. The distribution of respondents across these locations is provided in Table V. The table shows over 73 percent of the respondents were located at Strategic Air Command, Air Force Engineering and Services Center, Tactical Air Command, Headquarters United States Air Force, United States Air Forces in Europe, Pacific Air Forces, Military Airlift Command, Air Force Logistics Command, and Air Training Command. Strategic Air Command had the most

TABLE V

Location of Respondents

Location	Frequency		
	Absolute	Relative	Cumulative
Strategic Air Command	35	13.3	13.3
Air Force Engineering and Services Center	27	10.3	23.6
Tactical Air Command	21	0.8	31.6
Headquarters United States Air Force	20	7.6	39.2
United States Air Forces in Europe	19	7.3	46.5
Pacific Air Forces	19	7.3	53.8
Military Airlift Command	18	6.9	60.7
Air Force Logistics Command	17	6.5	67.2
Air Training Command	16	6.1	73.3
Air Force Systems Command	9	3.4	76.7
Alaskan Air Command	9	3.4	80.1
Space Command	8	3.1	83.2
AFRCE (Central Region)	8	3.1	86.3
AFRCE (Eastern Region)	8	3.1	89.4
Headquarters Air Force Reserve	7	2.7	92.1
AFRCE (Western Region)	7	2.7	94.8
AFRCE (United Kingdom)	4	1.5	96.3
Air Force Communications Command	3	1.1	97.4
AFRCE (Ballistic Missle Support)	3	1.1	98.5
Missing response	4	1.5	100.0
Total	262	100.0	

repondents--13.3 percent; the Air Force Engineering and Services Center with 10.3 percent of all respondents had the next highest percentage of respondents. The AFRCEs were ranked among those with fewest respondents.

Education Level. The education level of WIMS users was divided into six categories as shown in Table VI.

TABLE VI

Education Level of Respondents

Category	Frequency		
	Absolute	Relative	Cumulative
Non-high school graduate	1	0.4	0.4
High school graduate	18	6.9	7.3
Some college, no degree	68	25.9	33.2
Bachelor's degree	105	40.1	73.3
Masters degree	66	25.2	98.5
Doctoral degree	3	1.1	99.6
Missing response	1	0.4	100.0
Total	262	100.0	

The number of respondents in each category ranged from a low of 1 for non-high school graduate to a high of 105 for bachelor's degree. Table VI provides a complete breakdown of the respondents' education levels.

Prior Computer Experience. The length of computer experience by respondents prior to the implementation of WIMS was divided into nine categories as shown in Table VII. The table provides the number of respondents that fall into each category. Primarily, the sample of respondents is characterized by inexperienced computer users as 51.5 percent of respondents had less than one year of experience. Only 26.3 percent had between one and four years of experience, and 21.8 percent had over four years of experience.

TABLE VII

Length of Respondents' Computer Experience
Prior to the Implementation of WIMS

Category	Frequency		
	Absolute	Relative	Cumulative
0 to 6 months	108	41.2	41.2
7 to 12 months	27	10.3	51.5
13 to 18 months	18	6.9	58.4
19 to 24 months	21	8.0	66.4
25 to 30 months	13	4.9	71.3
31 to 36 months	8	3.0	74.3
37 to 42 months	7	2.7	77.0
43 to 48 months	2	0.8	77.8
over 48 months	57	21.8	99.6
Missing response	1	0.4	100.0
Total	262	100.0	

TABLE VIII

Respondents' Years of USAF Service

Category	Frequency		
	Absolute	Relative	Cumulative
4 years or less	36	13.8	13.8
5 to 8 years	39	14.9	28.7
9 to 12 years	39	14.9	43.6
13 to 16 years	43	16.4	60.0
17 to 20 years	31	11.8	71.8
21 to 24 years	33	12.6	84.4
25 to 28 years	22	8.4	92.8
29 to 32 years	9	3.4	96.2
Over 32 years	9	3.4	99.6
No response	1	0.4	100.0
Total	262	100.0	

Years of Service. The length of USAF service was divided into nine categories. The distribution of respondents in these categories is shown in Table VIII.

TABLE IX

Age of Respondents

Category	Frequency		
	Absolute	Relative	Cumulative
20 years and under	4	1.5	1.5
21 to 25 years	15	5.7	7.2
26 to 30 years	28	10.7	17.9
31 to 35 years	60	22.9	40.8
36 to 40 years	43	16.4	57.2
41 to 45 years	35	13.4	70.6
46 to 50 years	29	11.1	81.7
51 to 55 years	19	7.2	88.9
56 to 60 years	16	6.1	95.0
Over 60 years	11	4.2	99.2
Missing response	2	0.8	100.0
Total	262	100.0	

The 13 to 16 year category contained the most respondents (16.4 percent), and the bulk of the sample was evenly distributed across the categories that ranged from 0 to 24 years. Only 7 percent of respondents had over 24 years of service. Overall, the sample consisted of a balanced distribution of junior, middle and senior members of the USAF.

Age. The age of the respondents was categorized into ten groups. Table IX shows the distribution of age across these categories. It comprises a low proportion of 1.5 percent at the youngest age group (20 years and under), which grows to a maximum of 22.9 percent in the 31 to 35 year age group and then declines to a low proportion of 4.2 percent in the oldest age group (over 60 years). Of the

total sample, 74.5 percent of people were between the ages of 25 and 50, and 39.3 percent were in their thirties.

WIMS Success. The nine questions in Part II of the questionnaire provided data on the respondent's perception of how successful WIMS had been in achieving its objectives. All nine questions were answered by 216 of the 262 respondents. Table X displays the means and standard deviations of responses to each of these nine questions. Except for Questions 11 and 12, the means for the questions ranged from approximately 4.6 to 5.3. On the Likert scales used to answer these questions, this range represents a mean response of "small success" for Question 15 and a mean response of "small increase" for the other six questions. Means of the responses for Questions 11 and 12 were somewhat lower--3.85 and 3.77 respectively. On the Likert scale used to answer these two questions, these values represent a mean response of "very small decrease". Twenty-five respondents provided written amplification of their response to Question 15. Of these, 13 respondents reported that they do not use WIMS. Moreover, three respondents (one from each of HQ USAF, AFESC and HQ AFRES) did not know what WIMS was, even though they had been issued a WIMS User ID code (refer to sampling technique in Chapter III). Most written responses identified areas for improvement: seven people considered the user training inadequate; three people lost confidence in the accuracy of the WIMS data-base because of the monthly updates; six

TABLE X

Data Summary of Responses on WIMS Success

Question No	Question Content	Mean	Standard Deviation
7	Has WIMS changed your productivity?	4.9398	1.2872
8	Has WIMS changed your accuracy in decision-making?	4.8056	1.0562
9	Has WIMS changed your response time for making decisions?	4.6065	1.3426
10	Has WIMS changed the amount of information you use in your decision-making?	5.0926	1.1251
11	Has WIMS changed the amount of time you spend in preparing reports?	3.8519	1.7748
12	Has WIMS changed the amount of time you spend in reducing (consolidating) data?	3.7731	1.6953
13	Has WIMS changed the availability of information that you need to do your job?	5.2870	1.1416
14	Has WIMS changed the speed at which you circulate information in your work?	5.1481	1.2562
15	Has WIMS succeeded or failed?	5.0694	1.4009

people identified the need for more hardware to meet user needs; four people could not see how WIMS could benefit their work; two people saw WIMS as a mechanism for feeding data to top management; and seven people considered there to be insufficient management support for resources, additional systems staff, and time to devote to developing

computer applications. The only comment that commended WIMS was one person who stated that WIMS saved time for the user.

User Attitudes toward WIMS. The 56 statements in Part III of the questionnaire provided data on users' opinions of certain statements about WIMS and its implementation. By indicating the degree of agreement or disagreement to these statements, the data provided measures of various dimensions of user attitudes toward WIMS. All 56 statements were answered by 228 of the 262 respondents. Table XI tabulates the means and standard deviations of responses to the 56 attitude statements. The means ranged from approximately 2.4 to 3.8, thus indicating that most respondents expressed between slight disagreement and slight agreement for the statements.

Factor Analysis of WIMS Success Questions

Research Question 1 seeks to determine the relationship between user attitudes and the success of WIMS. The Part II questions (7 to 15) were constructed to quantify the success of WIMS for regression analysis with user attitudes. Whereas only one "Success" variable was required, these nine questions were reduced to the one variable that satisfactorily described the success of WIMS. Factor analysis of the nine questions was used to accomplish this goal.

TABLE XI

Data Summary of Responses on User Attitudes

Statement No	Statement Content	Mean	Standard Deviation
16	My job is more satisfying	3.1467	1.0690
17	Others can better see the results of my efforts	3.4254	1.0060
18	It is easier to perform my job well	3.3991	1.0960
19	The accuracy of information I receive is improved by WIMS	3.2675	1.0839
20	I have more control over my job	3.1404	1.0651
21	I am able to improve my performance	3.4956	0.9777
22	Others are more aware of what I am doing	3.3728	1.0095
23	The information I receive from WIMS makes my job easier	3.3377	1.0764
24	I spend less time looking for information	3.3816	1.1531
25	I am able to see better the results of my efforts	3.2982	1.0190
26	The accuracy of my work is improved as a result of using WIMS	3.3465	1.0939
27	My performance is more closely monitored	3.0219	1.0301
28	The division/directorate/ section performs better	3.3377	0.9687
29	I need to communicate with others more	3.1009	0.9634
30	I need the help of others more	2.7982	0.9309

TABLE XI (Continued)

Statement No	Statement Content	Mean	Standard Deviation
31	I need to consult others more often before making a decision	2.4386	0.8240
32	I need to talk with other people more	2.7149	0.9444
33	The individuals I work with are changing	2.9956	0.9641
34	The management structure is changing	3.0877	0.9578
35	WIMS does not require any changes in division/ directorate/section structure	2.9693	1.0299
36	I have had to get to know several new people	3.1140	1.0305
37	Individuals set higher targets for performance	2.9649	0.8798
38	The use of WIMS increases the Air Force's performance	3.5614	0.9055
39	This project (WIMS) is technically sound	3.6754	0.9526
40	Air Force goals are more clear	2.9693	0.8674
41	My counterparts in other divisions/directorates/ sections identify more with the Air Force's goals	2.8904	0.6712
42	The patterns of communication are more simplified	3.0307	0.9862
43	My goals and the Air Force's goals are more similar	3.0614	0.8982
44	The aims of my counterparts in other divisions/ directorates/sections are more easily achieved	3.2193	0.7362
45	My personal goals are better reconciled with the Air Force's goals	3.0570	0.8297

TABLE XI (Continued)

Statement No	Statement Content	Mean	Standard Deviation
46	Top management provides the resources to implement WIMS	3.1360	1.1240
47	People accept the required changes	3.2632	0.9344
48	Top management sees WIMS as being important	3.8070	0.8435
49	Implementing WIMS is difficult	3.4605	1.0715
50	Top management does not realize how complex this change is	3.1404	1.0142
51	People are given sufficient training to utilize WIMS	2.7456	1.2225
52	This project is important to top management	3.7982	0.8570
53	There is adequate staff available to successfully implement WIMS	2.8202	1.1489
54	My counterparts in other divisions/directorates/ sections are generally resistant to changes of this type	2.7325	0.7928
55	Personal conflicts have not increased as a result of WIMS	3.5351	0.8256
56	The developers of WIMS provide adequate training to users	2.6754	1.1106
57	The developers of WIMS do not understand management problems	2.7895	0.8072
58	I enjoy working with those who are implementing WIMS	3.7018	0.7383
59	When I talk to those implementing WIMS, they respect my opinions	3.4912	0.7596
60	WIMS costs too much	2.7061	0.7778
61	I am supported by my boss if I decide not to use WIMS	2.5219	0.9730

TABLE XI (Continued)

Statement No	Statement Content	Mean	Standard Deviation
62	Decisions based on WIMS are better	3.2061	0.9035
63	The results of WIMS are needed now	3.6491	0.8288
64	WIMS is important to me	3.5000	1.0967
65	I need WIMS	3.4123	1.1672
66	It was important that WIMS be used soon	3.7149	0.9303
67	This project is important to my boss	3.6228	0.8331
68	WIMS should have been put to use earlier	3.6228	0.9329
69	It was urgent that WIMS be implemented early	3.4825	0.9501
70	The sooner WIMS was in use the better	3.5877	0.9462
71	Benefits outweigh the costs	3.5482	0.9810

The first iteration of the procedure yielded two factors. Table XII shows the factor loadings and the communalities for all nine questions after the first iteration. Questions 7, 8, 9, 10, 13, 14 and 15 loaded significantly on Factor 1, and Questions 11 and 12 loaded significantly on Factor 2. An analysis of the content and wording of the Factor 1 questions confirmed that this factor indeed describes success of WIMS. However, Questions 11 and 12 both reflected a measure of time taken for users to complete tasks when using WIMS. Because of this, the researchers considered that Factor 2 described an

TABLE XII

First Iteration Communalities and Factor Loadings for WIMS Success Questions

Question No	Question Content	Commun -ality	Factor 1 Loading	Factor 2 Loading
7	Has WIMS changed your productivity?	0.5888	0.7458	-0.1804
8	Has WIMS changed your accuracy in decision-making?	0.6269	0.7799	-0.1364
9	Has WIMS changed your response time for making decisions?	0.2165	0.4502	0.1177
10	Has WIMS changed the amount of information you use in your decision-making?	0.5788	0.7600	-0.0359
11	Has WIMS changed the amount of time you spend in preparing reports?	0.6724	-0.0920	0.8148
12	Has WIMS changed the amount of time you spend in reducing (consolidating) data?	0.7106	-0.0266	0.8426
13	Has WIMS changed the availability of information that you need to do your job?	0.5076	0.7107	-0.0491
14	Has WIMS changed the speed at which you circulate information in your work?	0.4752	0.6893	-0.0120
15	Has WIMS succeeded or failed?	0.5211	0.7071	-0.1452

isolated facet of WIMS success. Accordingly, the researchers discarded Questions 11 and 12. Moreover, Factor 1 emerged with six variables loading high which provided more than enough data from which to analyze the success of WIMS. Finally, Question 9 was also eliminated because the communality was 0.2165 (minimum acceptable criteria established in Chapter III is 0.25).

Thus the final factor solution contained the one factor comprised of Questions 7, 8, 10, 13, 14 and 15. Of the 262 usable responses, this factor analysis used 221 cases to construct the scale (factor) of WIMS Success. Communalities and factor loadings f these six questions are tabulated in Table XIII. All values exceed the criteria established in Chapter III, which are 0.25 and 0.3 respectively. The WIMS Success factor accounted for 61.5 percent of the variance in the six questions from which it was constructed. This value exceeds the minimum acceptable value of 60 percent, which was established in Chapter III as the criteria.

Reliabilitity of the WIMS Success Factor. The Cronbach's Coefficient Alpha for the WIMS Success factor was calculated at 0.87166. Accordingly, the WIMS Success factor is a reliable scale and all component questions are consistent.

TABLE XIII

Final Communalities and Factor Loadings
for WIMS Success Questions

Question No	Question Content	Communality	Factor Loading
7	Has WIMS changed your productivity?	0.61686	0.78540
8	Has WIMS changed your accuracy in decision-making?	0.60061	0.77499
10	Has WIMS changed the amount of information you use in your decision-making?	0.53872	0.73398
13	Has WIMS changed the availability of information that you need to do your job?	0.48414	0.69580
14	Has WIMS changed the speed at which you circulate information in your work?	0.47392	0.68842
15	Has WIMS succeeded or failed?	0.51784	0.71961

Factor Analysis of User Attitude Statements

Besides "WIMS Success," "User Attitudes" also had to be quantified for the regression analysis that was used to answer Research Question 1. The 56 statements in Part III of the questionnaire (16 to 71) measured various user attitudes. Factor analysis of the responses to the statements was used to validate the questionnaire and to reduce the number of attitude variables to a smaller and more manageable set of variables.

Through several iterations of the factor analysis procedure, six statements were eliminated. Appendix C shows the communalities and factor loadings after the first iteration. Statement 35 was eliminated because of a low communality of 0.17735 and a low factor loading of 0.28510. Statement 36 was eliminated because of a low factor loading of 0.29306 (minimum acceptable criteria established in Chapter III is 0.3).

The factor analysis procedure was performed a second time by omitting Questions 35 and 36. Appendix D shows the communalities and factor loadings after the second iteration of the procedure. Statement 54 was eliminated because of a low communality of 0.12294 and a low factor loading of -0.18729. Statement 55 was eliminated because of a low communality of 0.22602 and a low factor loading of 0.29714. Statement 57 was eliminated because of a low communality of 0.18541, and Statement 61 was similarly eliminated because of a low communality of 0.15875.

The final factor solution extracted seven factors using 232 of the 262 cases. The seven factors accounted for 60 percent of the total variance in the remaining 50 statements that were analyzed. Appendix E contains the communalities and rotated factor matrix for this analysis. All factor loadings exceed the minimum criteria of 0.3, and all communalities exceed 0.25.

The seven factors were labeled as follows:

1. job performance,
2. sense of urgency,
3. organizational changes/clarity of goals,
4. implementation support/resistance,
5. interpersonal relations,
6. importance to top management, and
7. client/researcher relations.

Labeling of the factors was accomplished by ranking the statements under their respective factor in descending order of loadings. The content of the statements was then used to determine a suitable label. This procedure was also guided by labels used by other researchers in administering the Schultz and Slevin instrument (69; 70; 71:70-78; 76). The following paragraphs provide a discussion on each factor.

Job Performance (Factor 1). Factor 1 accounted for 57 percent of the variance in the data and contained 17 statements. The factor loadings and statements that comprised Factor 1 were as follows:

Loading	Number	Statement
0.793	26	The accuracy of my work is improved as a result of using WIMS.
0.772	21	I am able to improve my performance.
0.769	22	Others are more aware of what I am doing.
0.769	25	I am able to see better the results of my work.

Loading	Number	Statement
0.750	16	My job is more satisfying.
0.734	17	Others can better see the results of my efforts.
0.728	18	It is easier to perform my job well.
0.705	19	The accuracy of information I receive is improved by WIMS.
0.700	20	I have more control over my job.
0.650	28	The division/directorate/section performs better.
0.644	23	The information I receive from WIMS makes my job easier.
0.585	24	I spend less time looking for information.
0.561	38	The use of WIMS increases the Air Force's performance.
0.510	62	Decisions based on WIMS are better.
0.473	37	Individuals set higher targets for performance.
0.444	42	The patterns of communication are more simplified.
0.326	27	My performance is more closely monitored.

Most of the statements contain the underlying element of user attitudes toward the impact that WIMS has in improving job performance. Thus, the factor was labeled "job performance."

Sense of Urgency (Factor 2). The second largest factor describes the user attitude on the sense of urgency of implementing WIMS. This factor accounted for 12.3 percent of the variance in the data and contained ten

statements. The factor loadings and statements for Factor 2 were as follows:

Loading	Number	Statement
0.828	70	The sooner WIMS was in use the better.
0.769	69	It was urgent that WIMS be implemented.
0.754	71	Benefits outweigh the costs.
0.732	68	WIMS should have been into use earlier.
0.731	66	It was important that WIMS be used soon.
0.720	64	WIMS is important to me.
0.717	63	The results of WIMS are needed now.
0.690	65	I need WIMS.
-0.496	60	WIMS costs too much.
0.355	39	This project (WIMS) is technically sound.

Except for the two lowest loading statements (39 and 60), these statements all describe how the user feels about implementing WIMS as soon as possible. Therefore, the label "sense of urgency" was appropriate. Although Statements 39 and 60 were about different subjects, their low factor loadings, compared to the other strong factor loadings, reduces their significance to the contribution toward factor interpretation.

<u>Organizational Changes/Clarity of Goals (Factor 3)</u>. A further 10.7 percent of the variance in the data was explained by the third factor which was labeled

"organizational changes /clarity of goals." The factor loadings and statements for Factor 3 were as follows:

Loading	Number	Statement
0.551	45	My personal goals are better reconciled with Air Force goals.
0.541	41	My counterparts in other divisions/ directorates/sections identify more with the Air Force's goals.
0.540	43	My goals and the Air Force's goals are more similar.
0.513	40	Air Force goals are more clear.
0.490	33	The individuals I work with are changing.
0.426	34	The management structure is changing.
0.349	44	The aims of my counterparts in other divisions/directorates/sections are more easily achieved.

The factor contains seven statements of which two (33 and 34) relate to organizational changes, and the other five relate to goals of the user, of other people and of the organization. The common element between these two groups of statements is the organizational setting.

Implementation Support/Resistance (Factor 4). The fourth factor was labeled "implementation support/ resistance." It contained seven statements and explained a further 6.8 percent of the total variance of all the statements. The factor loadings and statements for Factor 4 were as follows:

Loading	Number	Statement
0.713	56	The developers of WIMS provide adequate training to users.

Loading	Number	Statement
0.651	51	People are given sufficient training to use WIMS.
-0.610	50	Top management does not realize how complex this change is.
0.455	47	People accept the required changes.
-0.452	49	Implementing WIMS is difficult.
0.424	53	There is adequate staff av*ilable to successfully implement WIMS.
0.316	46	Top management provides the resources to implement WIMS.

These seven statements share the common element of the provision of resources (e.g., training, staff) to implement a difficult change. Adequate resources entails support for WIMS, whereas restriction of resources entails resistance to WIMS. Accordingly, the label "implementation support/ resistance" was attached to this factor.

Interpersonal Relations (Factor 5). The next factor contained four statements and explained 5.2 percent of the variance of the data. It was labeled "interpersonal relations." The factor loadings and statements for this factor were as follows:

Loading	Number	Statement
0.834	32	I need to talk with other people more.
0.724	30	I need the help of others more.
0.724	31	I need to consult others more often before making a decision.
0.548	29	I need to communicate with others more.

There was no doubt that these statements were focusing on how one relates with others at work. Accordingly, the label "interpersonal relations" was selected.

Importance to Top Management (Factor 6). The sixth factor contained three statements and accounted for 4.5 percent of the total variance of the data. The factor loadings and statements for this factor were as follows:

Loading	Number	Statement
0.858	52	This project is important to top management.
0.683	48	Top management sees WIMS as being important.
0.390	67	This project is important to my boss.

Whereas Factor 4 contained statements on top management support for resources, this factor identifies the importance of WIMS to top management. Therefore, this factor was labeled "importance to top management."

Client/Researcher Relations (Factor 7). The final factor contained only two statements and accounted for 3.4 percent of the total variance of the data. The factor loadings and statements for Factor 7 were as follows:

Loading	Number	Statement
0.816	59	When I talk to those implementing WIMS, they respect my opinions.
0.480	58	I enjoy working with those implementing WIMS.

These two statements focus on the relations between the user and the WIMS implementation team and staff. Although a label of "user/implementation staff relations" may seem

more appropriate, the label "client/researcher relations" was used to conform with previous research where the Schultz and Slevin attitude questionnaire was also used.

Validity of Questionnaire. The interpretation of any factor analysis is always subjective. In particular, much depends on the criteria used to eliminate variables (e.g., communalities and factor loadings). In this analysis, the final factor structure was slightly different from the analysis conducted by Schultz and Slevin in their study. Whereas this study confirmed the emergence of seven predominant factors, the composition of the factors differed as follows:

1. Factor 1 (job performance) consisted of the statements in Schultz and Slevin's "job performance" factor plus Statements 37, 38, 42 and 62.

2. Except for Statements 61 (deleted), 62 and 67, Factor 2 (sense of urgency) consisted of the statements in Schultz and Slevin's "sense of urgency" factor.

3. Except for Statements 35 and 36 (both deleted), 37, 38, 39 and 42, Factor 3 (organizational changes/clarity of goals) consisted of the statements in Schultz and Slevin's "organizational changes" factor and "clarity of goals" factor.

4. Except for Statements 48, 52, 54 and 55 (last two deleted), Factor 4 (implementation support/resistance) consisted of the statements in Schultz and Slevin's "implementation support" factor.

5. Factor 5 (interpersonal relations) consisted of the same statements as those in Schultz and Slevin's "interpersonal relations" factor.

6. Factor 6 (importance to top management) consists of Statements 48, 52 and 67, all of which describe the importance of WIMS to top management.

TABLE XIV

Reliability Coefficients for Attitude Factors

Factor	Cronbach's Coefficient Alpha
1. Job Performance	0.95
2. Sense of Urgency	0.93
3. Organizational Changes/ Clarity of Goals	0.79
4. Implementation Support/Resistance	0.74
5. Interpersonal Relations	0.81
6. Importance to Top Management	0.73
7. Client/Researcher Relations	0.73

7. Except for Statement 57 (deleted), Factor 7 (client/researcher relations) consists of the statements in Schultz and Slevin's "client/researcher relations" factor.

Overall, the differences are small. Six variables were deleted on statistical grounds in the factor analysis. The movement of some statements from one factor (in Schultz and Slevin's study) to a different factor (in this study) is tolerable because these statements had similar factor loadings on two factors. Consequently, small differences in the nature of the data base could easily shift the final factor loading for these statements. Accordingly, the questionnaire is considered valid.

Reliability of the Attitude Factors. Cronbach's Coefficient Alpha was calculated for each of the seven attitude factors. The reliability coefficients are tabulated in Table XIV and range from 0.73 to 0.95. These values are acceptable and confirm the strength of the factors and the consistency of the statements.

TABLE XV

Stepwise Regression of Attitude Factors as Predictors of WIMS Success

Step	Independent Variable	r	Beta	R-Squared	Change in R-Squared
1	Job Performance	0.76393	0.59116	0.58359	0.58359
2	Sense of Urgency	0.64838	0.26973	0.62649	0.04291
		Total R-Squared = 0.62650			

Regression Analysis of WIMS Success vs Attitudes

The above factor analyses have reduced the data to one dependent variable (WIMS success) and seven independent variables (attitude factors). To answer Research Question 1, a stepwise regression analysis was performed between WIMS success and user attitudes.

The significant results of the regression between WIMS success and user attitudes appear in Table XV. Only two of the seven attitude factors entered the regression equation as significant predictors of success at the 0.95 significance level. These variables were "job performance" and "sense of urgency."

The first variable to enter the equation was "job performance." It explains 58 percent of the variance in the dependent variable and maintains a positive relationship with the dependent variable.

The second variable to enter the regression equation was "sense of urgency." Alone with "WIMS success," the

variable "sense of urgency" has a correlation coefficient of 0.64838. However, when it enters the regression equation after the variable "job performance," it only explains a further 4.3 percent of the variance of the dependent variable "WIMS success." "Sense of urgency" maintains a positive relationship with "WIMS success."

The remaining five attitude factors do not hold a significant relationship with WIMS success at the 0.95 significance level.

Residual Analysis. A scatterplot of the residuals of "WIMS Success" displayed no definite pattern. Accordingly, the regression assumptions in Chapter III were valid.

Regression Analysis of WIMS Success vs the Demographic Variables

The regression analysis described above found that there is a positive relationship between "WIMS success" and attitudes ("job performance" and "sense of urgency"). To help answer Research Question 2, the first set of analyses that were conducted were bivariate regressions between "WIMS success" and each of the demographic variables.

The significant results of these bivariate regressions appear in Table XVI. Of the 19 locations, Space Command was the only location that showed a significant relationship with "WIMS success." It explains 3.6 percent of the variance in the dependent variable and maintains a positive relationship with the dependent variable.

TABLE XVI

Bivariate Regressions of Each Demographic Variable as Predictors of WIMS Success

Independent Variable	r	Beta	R-Squared
Space Command	0.19049	0.19049	0.03629
Persons with at least a Bachelor's degree	-0.14308	-0.14308	0.02047
Persons with more than six months computer experience	0.15085	0.15085	0.02276
Persons over 35 years old.	-0.13506	-0.13506	0.01824

Another demographic variable that showed a significant relationship with WIMS success was "persons with at least a bachelor's degree." This variable explains 2 percent of the variance of the dependent variable and maintains a negative relationship with "WIMS success."

A third demographic variable that related significantly with "WIMS success" was "persons with six months or more computer experience." This variable explains 2.3 percent of the variance of the dependent variable and maintains a positive relationship with WIMS success.

The only other demographic variable that was found to be related to "WIMS success" was "persons over 35 years old." This variable explains 1.8 percent of the variance

TABLE XVII

Bivariate Regressions of Each Demographic Variable as Predictors of Job Performance Attitudes

Independent Variable	r	Beta	R-Squared
Tactical Air Command	0.1338	0.1338	0.01790
Persons with at least a bachelor's degree	-0.2162	-0.2162	0.04674
Persons over 35 years old	-0.1532	-0.1532	0.02347

of the dependent variable and maintains a negative relationship with "WIMS success."

Residual Analysis. A scatterplot of the residuals of "WIMS Success" for each of the regression analyses in Table XVI displayed no definite pattern. Accordingly, the regression assumptions in Chapter III were valid.

Regression Analysis of the Job Performance Attitude Factor vs the Demographic Variables

The second set of analyses that were conducted to help answer Research Question 2 were bivariate regressions between the job performance attitude factor and each of the demographic variables. The significant results of these bivariate regressions appear in Table XVII.

Of the 19 locations, only Tactical Air Command displayed a significant relationship with the job performance attitude. This variable accounts for 1.8

percent of the variance in the dependent variable and maintains a positive relationship with the job performance attitude variable.

"Persons with at least a bachelor's degree" was another variable that related significantly with the job performance attitude. This variable explains 4.7 percent of the variance in the dependent variable and maintains a negative relationship with the job performance attitude variable.

Finally, "persons over 35 years old" also related significantly with the job performance attitude variable. It explains 2.3 percent of the variance in the dependent variable and maintains a negative relationship with the job performance attitude variable.

Residual Analysis. A scatterplot of the residuals of the job performance attitude variable for each of the regression analyses in Table XVII displayed no definite pattern. Accordingly, the regression assumptions of Chapter III were valid.

Regression Analysis of the Sense of Urgency Attitude Factor vs the Demographic Variables

The third and final set of analyses conducted to help answer Research Question 2 were bivariate regressions between the sense of urgency attitude variable and each of the demographic variables. The significant results of these analyses are tabulated in Table XVIII.

TABLE XVIII

Bivariate Regression of Demographic Variables as Predictors of Sense of Urgency Attitudes

Independent Variables	r	Beta	R-Squared
Persons with at least some college	0.1447	0.1447	0.02094
Persons with more than six months computer experience	0.1517	0.1517	0.02301
Persons over 35 years old	-0.1471	-0.1471	0.02164

A positive relationship exists between "persons with at least some college" and "sense of urgency." The former variable explains 2.1 percent of the variation in the dependent variable.

Another demographic variable that showed a significant relationship with "sense of urgency" was "persons with more than six months computer experience." This demographic variable displayed a positive relationship with the dependent variable and explained 2.3 percent of the latter's variance.

One other demographic variable that related significantly to "sense of urgency" was "persons over 35 years old." The relationship was negative in which the independent variable explained 2.2 percent of the variance of "sense of urgency."

Residual Analysis. A scatterplot of the residuals of the sense of urgency attitude factor for each of the regression analyses in Table XVIII displayed no definite pattern. Accordingly, the regression assumptions in Chapter III were valid.

Summary

The statistical analyses of this chapter accomplished three objectives. First, it validated the research questionnaire. Then, the "WIMS success" data was reduced to one variable and the attitudinal data was reduced to seven variables. Finally, the statistical analyses provided answers to the two research questions.

For the first research question, the analysis found positive relationships between "WIMS success" and "user attitude about job performance," and between "WIMS Success" and "user attitude about a sense of urgency for WIMS."

For the second research question, all four demographic variable groups (location, education, prior computer experience and age) affected the success of WIMS and the two significant attitudes to varying degrees. Specifically for location, "Space Command" was found to have a positive relationship with "success of WIMS," and "Tactical Air Command" was found to have a positive relationship with "user attitude about job performance." For education, the analysis showed a negative relationship between "WIMS success" and "persons with at least a bachelor's degree".

Also, a negative relationship was shown between "persons with at least a bachelor's degree" and "user attitudes about job performance." Furthermore, "persons with at least some college" was positively related to "user attitudes about a sense of urgency for implementing WIMS." For age, negative relationships were found between "persons over 35 years old" and "WIMS success," job performance attitudes and sense of urgency attitudes. For prior computer experience, "persons with more than six months computer experience" was significantly related with "WIMS success" and with sense of urgency attitudes.

V. Conclusions and Recommendations

Summary of Research

This research study developed from a concern for the success of the Work Information Management System (WIMS). The system will be implemented world-wide in the USAF's Engineering and Services organizations between 1984 and 1987 at a cost of $95 million. Early leasing of computer equipment at Headquarters Air Force, Headquarters Air Force Reserve, Air Force Engineering and Services Center, Major Commands (MAJCOM), and Air Force Regional Civil Engineer (AFRCE) offices enabled the MAJCOM and AFRCE WIMS to be implemented during 1983 and 1984. Such early leasing provided the opportunity to study the implementation effort of this smaller scale project before the Air Force embarked on the larger scale world-wide implementation of WIMS.

Considering the large financial investment involved in WIMS, the United States Air Force wants to insure the success of WIMS. Success was found to be best defined by the degree to which WIMS achieves its objectives. The objectives of WIMS orientate toward the user to improve his/her performance at work. Thus, the factors that promote or jeopardize the successful implementation of WIMS became of major interest in this study.

The researchers explored the literature on implementation success of management information systems

(MIS). The review in Chapter II found "user attitudes" to be a correlate of MIS success. In particular, MIS users who felt the MIS improved their job performance, clarified their work goals, and provided a sense of urgency experienced more success with the MIS. The users who felt the MIS did not improve their job performance, did not clarify their work goals, and did not provide a sense of urgency experienced less success with the MIS. The more positive the user attitudes, the more successful was the MIS. The more negative their attitudes, the less successful was the MIS. Nevertheless, the relationship between attitudes and MIS success was observed only cross-sectionally, so causality was difficult to determine.

The literature also provided an insight into other factors that might affect user attitudes and MIS success. These factors include location (relevant for MIS installed at more than one location), user age, user education, and user experience with computers.

The literature identified these areas as targets for MIS implementation research. Furthermore, it was in the interests of the USAF that these areas as related to WIMS be studied. Therefore, two research questions were developed. The first sought to establish the relationship between user attitudes and the success of WIMS. The second sought to study the effect of location, user education, user age and user computer experience on user attitudes and the success of WIMS.

To answer these questions, the researchers used the Schultz and Slevin Attitude Questionnaire to gather data on user attitudes, and constructed a number of questions based on the objectives of WIMS to gather data on the success of WIMS. These questions, together with demographic questions on location, user education, user age and user experience with computers were administered to a stratified proportionate sample of 400 users drawn from all implementing organizations. The researchers used factor analysis and regression analysis to analyze the data for answers to the two research questions.

Discussion of Results and Implications of Research

Success of WIMS is the ultimate goal for this implementation project. WIMS success was measured using the six questions listed in Table XIII. Table X provides the means for these six questions. The mean values for the six questions range from 4.6 to 5.3, which indicates overall that the average user perception of WIMS success was one of a small success. Looking at each of the six questions in turn gives a clearer view of how users, on the average, rated the success of WIMS. First, WIMS has resulted in a small increase in individual productivity. Second, it has led to a small increase in the accuracy of individual decision-making. Next, WIMS resulted in a small increase in the amount of information that users use in decision-making. WIMS has also resulted in a small

increase in the availability of information that users need to do their jobs. Next, WIMS has resulted in a small increase in the speed at which users work. And finally, the overall assessment by users was that to date WIMS has achieved a small amount of success.

These results are pleasing when one considers that all six component objectives of WIMS success were being met, albeit to a small extent. As WIMS is in an early stage of operation, greater success could follow when users become more familiar with its operation and widen their use of computer applications. However, to make such a conclusion would require a longitudinal study. Moreover, this study was more concerned with the factors that promote or jeopardize the success of WIMS rather than evaluating the degree of success. Accordingly, it is suffice to say that WIMS appears to be succeeding but only to a small extent, and that a longitudinal study is required to evaluate the long-term success of WIMS.

Focusing this discussion on the purpose of this research, the study did find relationships in which the success of WIMS is promoted and jeopardized. Overall, the results of the analyses for the two research questions tended to support the literature review. User attitudes were found to be significantly related to the success of WIMS, and the demographic variables (location, age, education, and prior computer experience) were found to be significantly related to user attitudes and to the success

of WIMS. These results are now discussed in greater detail. The following discussion also identifies the specific implications that these results have for the United States Air Force and WIMS implementation staff.

Foremost, a significant relationship was found between user attitudes and the success of WIMS. Users develop attitudes about many aspects of WIMS. These behavioral feelings were condensed into seven attitudes. Two of these attitudes (job performance, and sense of urgency) obtained a significant relationship with the success of WIMS. That is, the success of WIMS was found to be associated more with those users displaying these two attitudes. These two attitudes were found to be the only significant attitudes related to success in one other study (71:70-78). However, other studies (69; 70; 73) have found a third attitude--goal clarity--to be also significantly related to success. Goal clarity was not significant in this research.

The first of these attitudes was job performance. Users who display a favorable attitude about how WIMS contributes to their individual job performance and visibility are more likely to experience success with WIMS than those users who do not. Whether it is the favorable attitude that causes the success of WIMS or the success of WIMS that causes the favorable attitude is a perplexing and difficult issue to resolve. The direction of the relationship cannot be established from this cross-

sectional study. Quite possibly both directions of the relationship are operating in which case the favorable attitude and the success of WIMS reinforce each other. This possibility was illustrated in Figure 8 of the literature review. Figures 6, 7 and 10 of the literature review depicted attitudes as the cause of success.

Despite the uncertainty of the direction of the relationship between WIMS success and a user's attitude about WIMS contributing toward individual job performance and visibility, the USAF can still take actions which could promote the success of WIMS. Because this attitude had such a strong relationship with WIMS success (correlation coefficient was 0.76), one of the USAF's primary implementation strategies should be to foster attitudes among users that enable users to appreciate how WIMS can contribute to one's individual job performance and job visibility. This does not mean that the USAF should embark upon a hard-sell, top-down push to make users develop this attitude--in fact, such an approach will more likely develop negative attitudes. Rather, the approach by implementation teams should be one of education. Users should be freely (not forcefully) exposed to the benefits of WIMS. Films and demonstrations would be suitable strategies. Bulletin board notices and leaflets would support such efforts. Encouragement and involvement of users in the development of local computer applications would also expose users to the advantages of using WIMS.

Overall, the emphasis is to foster favorable user attitudes about how WIMS can contribute toward individual job performance and visibility. The bottom line of these efforts is to convince users that WIMS is not solely focused toward management needs--as is the traditional management information system--but is more oriented toward individual needs and the improvement of individual performance. Having promoted these attitudes, the USAF can expect the users to experience more success with WIMS in the form of higher productivity, more accurate decision-making, more informed decision-making, increased information availability, and quicker turnover of work --these being the component objectives of WIMS success.

The second of the two attitudes that was found to be significantly related to success of WIMS was sense of urgency. This attitude relates to the degree in which users sense the urgency and importance for the implementation of WIMS. Users who display a positive attitude about the urgency for WIMS are more likely to experience success with WIMS than those users who do not. Again, as discussed previously with the relationship between WIMS success and favorable attitudes about how WIMS contributes toward individual job performance, the direction of the relationship between WIMS success and one's attitude about the urgency for WIMS can not be determined from this study.

Although the direction of the relationship between WIMS success and user attitudes about the sense of urgency of WIMS is uncertain, the USAF should take actions to promote this outcome. WIMS success cannot be promoted directly, but since its occurrence is highly correlated with user attitudes about the urgency and importance of WIMS (correlation coefficient was 0.65), efforts should be directed to promote such attitudes. The USAF should incorporate efforts into their implementation strategies that would foster favorable user attitudes about the urgency and importance of WIMS.

The strategies designed to foster favorable user attitudes about WIMS contribution to individual performance would also foster favorable user attitudes about the urgency of WIMS because a user would normally attach a high degree of urgency to improving his/her job performance. This explanation is consistent with the regression analysis summarized in Table XV. It shows that although attitudes about sense of urgency are highly correlated with the success of WIMS, these attitudes explain only an additional 4.3 percent (Change in R-sqared was 0.04291) of the variance in WIMS success after attitudes about individual job performance had explained the first 58 percent of the variance. That is, both attitudes share a lot in common. Thus, efforts to promote both of these attitudes share common strategies.

This study found that not only the two user attitudes discussed above correlate with WIMS success, but also location, education, computer experience and age correlate with WIMS success. However, the strength of the relationship of each of these demographic variables with WIMS success is much less than the strong relationships exhibited between each of the two attitudes and WIMS success. Table XVI shows Coefficients of Determinations for these four demographic variables to range from 0.018 to 0.036. These findings are discussed because they do relate significantly to the success of WIMS. However, since the relationships are much weaker, the emphasis of implementation strategies would be to first foster the attitudes discussed above. Then, these demographic factors should be considered to further refine local implementation strategies. The effect of each of these demographic variables on the success of WIMS, on user attitudes about WIMS contribution to individual job performance, and on user attitudes about one's sense of urgency for implementation of WIMS is described in the following discussion.

The effect of location on the success of WIMS and on user attitudes about job performance and about sense of urgency was pronounced in only two cases. The first case involved Space Command at Peterson AFB, Colorado. Table XVI shows that the regression analyses of each location in turn with WIMS success found Space Command to be the only implementing organization that held a relationship with

WIMS success. The relationship was positive which means that users at Space Command have more success with WIMS than do users from other organizations. From the data collected, no explanation could be found as to why this was so. In fact, Space Command did not demonstrate a significant correlation with user attitudes. Therefore, the cause for Space Command's success with WIMS can not be determined from this study and thus remains an issue which requires further study. The interview technique would be an excellent method to collect data to resolve this issue.

The second case in which location demonstrated a significant relationship was Tactical Air Command at Langley AFB VA. Table XVII shows that the regression analyses of each location in turn with user attitudes about job performance found Tactical Air Command to be the only implementing organization with a significant relationship. The relationship was positive which means that users at Tactical Air Command have more favorable attitudes about the contribution of WIMS toward their job performance than do users at other implementing organizations. Although it was discussed earlier that such favorable attitudes are correlates of WIMS success, Tactical Air Command did not display a significant relationship with success of WIMS. The reason for this is that Tactical Air Command accounts for only 1.8 percent of the variation of a user's attitude about job performance. When this small proportion of variance is applied to the proportion of variance in WIMS

success explained by a user's attitude about job performance, the resulting relationship fails to be significant at the 0.95 level. Again, this observation reinforces the earlier comment of the low strengths of the relationships displayed by the demographic variables.

The effect of education on the success of WIMS and on user attitudes about job performance and about sense of urgency was found to be significant in all three cases. The first case relates to the relationship between education of the user and the success of WIMS. As shown in Table XVI, a negative relationship exists between those persons with at least a bachelor's degree and the success of WIMS. Although the strength of the relationship is not strong (Coefficient of Determination is 0.020), it does provide an insight into the effect of education. Thus, the indication is that more educated individuals experience less success with WIMS than do less educated individuals. A similar conclusion was made by Lucas in his study of 400 account executives (58:148).

The second effect of education was its significant relationship with user attitudes about how WIMS contributes toward individual job performance. Again a negative relationship exists. From Table XVII, the strength of the relationship is weak (Coefficient of Determination is 0.047), but because it is significant, it warrants discussion. The implication from this finding is that more educated individuals tend to develop more negative

attitudes about the way in which WIMS affects their job performance. As an explanation, more educated users may see themselves as contributing most toward their high standard of job performance and visibility rather than WIMS. At the other extreme, less educated individuals may be fascinated by what WIMS can do and attribute this to their job performance and visibility.

The third effect of education was in relation to user attitudes about one's sense of urgency for implementation of WIMS. From Table XVIII, a positive relationship was found between those persons with at least some college education and the user's attitude about the urgent need for WIMS. Again the relationship was weak (Coefficient of Determination is 0.021). This relationship indicates that more educated individuals more readily appreciate the need for WIMS than do less educated individuals.

The implications of education in relation to the implementation of WIMS should affect local implementation strategies. Implementation teams should give special attention to less educated users to encourage a sense of urgency for WIMS, and they should emphasize the benefits of WIMS on job performance and visibility more so with the more educated individuals.

The effect of age was consistent in that younger users demonstrate better success with WIMS and display better attitudes than do older users. Significant but weak relationships were found between those users over 35 years

old and each of user attitudes and WIMS success. The Coefficients of Determination for these three relationships ranged from 0.018 to 0.023. The implications of concern are that older users experience less success with WIMS and develop less favorable attitudes about the potential for WIMS to improve their job performance and less favorable attitudes about the urgency for implementation of WIMS. Accordingly, implementation teams should give special attention to older users to insure that the implementation strategies are generating the desired behaviors. This concern has been shared in previous research (58:143; 60:54; 63).

The final demographic variable to be studied was the effect of a user's prior computer experience on his/her success with WIMS and his/her attitudes. Two positive relationships were found to exist. The first was between those persons with over six months computer experience and the success of WIMS; the second was between those persons with over six months computer experience and those persons with a favorable attitude about the urgency for the implementation of WIMS. Both relationships are weak (respective Coefficient of Derminations are 0.023 and 0.022). The implications of these findings are that users with prior computer experience are more likely to demonstrate a favorable attitude toward the urgency of implementing WIMS and are more likely to experience success with WIMS than will less experienced users. Accordingly,

this finding should provide implementation teams with further guidance to focus efforts on less experienced users.

To put the above discussion in proper perspective, the implementation of WIMS should proceed with implementation strategies that include the fostering of favorable user attitudes about the potential for WIMS to improve individual job performance and about the urgency for WIMS to be implemented. The strategies should then refine these efforts to take account of the effect location, education, age, and prior computer experience. Having incorporated these strategies, WIMS will be more likely to succeed.

Conclusion

At this early stage of operation, WIMS appears to be on the way to success. However, only minimal success has been achieved to date. A longitudinal study is required to evaluate the long-term success of WIMS. It is anticipated that as users become more aware of its ability to improve job performance, WIMS will be perceived as being more successful.

User attitudes were found to be significantly related to success of WIMS. The success of WIMS was greater with those users who had positive attitudes about how WIMS would improve their job performance and with those users who had positive attitudes about the urgent need for implementation of WIMS. Conversely, the success of WIMS was less with

those users who demonstrated negative attitudes about how WIMS would improve their job performance and with those who demonstrated negative attitudes about how urgent was the need for WIMS. One of the USAF's primary implementation strategies should be to foster attitudes among users that enable users to appreciate how WIMS can contribute to one's individual job performance and visibility and that enable users to sense the urgent need for the implementation of WIMS.

The effect of location was pronounced in only two of the nineteen locations. Users at Space Command experienced more success with WIMS than did users at other implementing organizations. No explanation could be concluded for this relationship. Users at Tactical Air Command displayed more favorable attitudes about how WIMS contributes to their job performance than did users at other implementing organizations. This is not surprising because Tactical Air Command was the first organization to implement WIMS.

The education of the user played an important role in this study. It was found that the higher the level of education by the user, the more negative was his attitude about job performance and the more likely WIMS was perceived not to be successful. However, more educated persons did demonstrate a greater sense of urgency about WIMS.

Age significantly affects WIMS success and attitudes. Younger people display more positive attitudes and report more success with WIMS than do older people.

The final effect that was considered was the length of computer experience the user had prior to the implementation of WIMS. This study found that persons with more experience had more positive attitudes and reported more success with WIMS.

This study has provided some guidelines for the Air Force to develop its implementation strategies for the world-wide implementation of WIMS. It also serves as a reference for other organizations in the implementation of similar projects. Finally, the study has added to the body of knowledge in implementation research and hopefully will stimulate further research in this subject.

Recommendations

This research study explored the overall relationships between WIMS success, user attitudes about job performance and sense of urgency, and demographic features of the user including location, user education, user age, and user experience with computers. The results of the study have revealed a number of patterns in the relationships between these variables. What needs to be done now is to study these relationships both individually and in combination with other variables to explain more of the observed variations.

Another area for further research is to continue this study at a later date to determine whether the pattern of relationships uncovered in this study change over time. Further studies could use this study as a framework to study the success of WIMS during the world-wide implementation.

Of ultimate concern is the overall success of WIMS. A longitudinal study needs to be conducted to properly evaluate the success of WIMS and to determine causality.

Finally, research should continue to identify more variables which could be used to explain the success or failure of management information systems.

Appendix A: Research Questionnaire

DEPARTMENT OF THE AIR FORCE
AIR FORCE INSTITUTE OF TECHNOLOGY (AU)
WRIGHT-PATTERSON AIR FORCE BASE, OH 45433

REPLY TO ATTN OF: LSH (AFIT/GEM/LSM/84S-15)/SqnLdr K. W. Moschner/ Capt F. W. Nightengale/AUTOVON 785-4437

11 June 1984

SUBJECT: Attitude Questionnaire for the Work Information Management System (WIMS)

TO:

1. The attached questionnaire was prepared by a research team at the Air Force Institute of Technology at Wright-Patterson Air Force Base. The research team will use the results of the survey to evaluate the relationship between the attitude of WIMS users and the success of WIMS.

2. Please take a few minutes to complete the questionnaire. You do not need to give your name. Just complete the questionnaire, seal the completed computer score sheet in the attached envelope and give it to your WIMS System Administrator as soon as possible. Your WIMS System Administrator will then forward all of the responses from your organization to the researchers.

3. Although your participation in this survey is voluntary, your input will be extremely valuable in the overall evaluation of the success of WIMS throughout the Air Force. Thank you for your cooperation.

Larry L. Smith

LARRY L. SMITH, Colonel, USAF
Dean
School of Systems and Logistics

3 Atch
1. Questionnaire (AF SCN 84-60)
2. Computer Score Sheet
3. Return Envelope

AIR FORCE—A GREAT WAY OF LIFE

ATTITUDE QUESTIONNAIRE FOR THE
WORK INFORMATION MANAGEMENT SYSTEM (WIMS)

This questionnaire is divided into three parts. The first part asks for information on your duty location, education level, computer experience, years of service, and age. The second part asks for your evaluation of how WIMS has changed certain characteristics of your work. Your opinions toward various aspects of WIMS is then sought in the third part.

Please provide only one answer to each question, and mark your answer against the corresponding number on the attached computer score sheet. It is not necessary to complete the sections of the score sheet which ask for your name, date and identification number. Use a number 2 pencil, and insure you do not mark outside the boxes provided for your answers.

Part I

Questions 1 and 2 apply to the HQ/MAJCOM/AFRCE to which you are assigned. Please answer only one of the two.

1.
   1. AAC
   2. AFCC
   3. AFLC
   4. AFSC
   5. ATC
   6. MAC
   7. PACAF
   8. SAC
   9. SPACECOM
   10. TAC

2.
   1. AFESC
   2. USAFE
   3. HQ AFR
   4. HQ USAF
   5. AFRCE (BMS)
   6. AFRCE (CR)
   7. AFRCE (ER)
   8. AFRCE (UK)
   9. AFRCE (WR)

3. What is your highest education level?
   1. Non-high school graduate
   2. High school graduate or GED
   3. Some college but no degree
   4. Bachelor's degree
   5. Master's degree
   6. Doctoral degree

4. How much experience have you had with computers or management information systems prior to WIMS?
   1. 0 to 6 months
   2. 7 to 12 months
   3. 1 to 1 1/2 yrs
   4. 1 1/2 to 2 yrs
   5. 2 to 2 1/2 yrs
   6. 2 1/2 to 3 yrs
   7. 3 to 3 1/2 yrs
   8. 3 1/2 to 4 yrs
   9. Over 4 yrs

5. How many years of service do you have (military and/or civil service)?
   1. 4 yrs or less
   2. 5 to 8 yrs
   3. 9 to 12 yrs
   4. 13 to 16 yrs
   5. 17 to 20 yrs
   6. 21 to 24 yrs
   7. 25 to 28 yrs
   8. 29 to 32 yrs
   9. Over 32 yrs

6. What is your age group?

1. 20 years or under.	6. 41 to 45 years.
2. 21 to 25 years.	7. 46 to 50 years.
3. 26 to 30 years.	8. 51 to 55 years.
4. 31 to 35 years.	9. 56 to 60 years.
5. 36 to 40 years.	10. Over 60 years.

Part II

Please use the following scale to answer questions 7 through 14:

1	2	3	4	5	6	7
Large Decrease	Moderate Decrease	Small Decrease	No Change	Small Increase	Moderate Increase	Large Increase

NOTE: If a question does not apply to you, do not answer it nor mark the score sheet for that question.

7. How has WIMS changed your productivity?

8. How has WIMS changed your accuracy in decision-making?

9. How has WIMS changed your response time for making decisions?

10. How has WIMS changed the amount of information you use in your decision-making?

11. How has WIMS changed the amount of time you spend in preparing reports?

12. How has WIMS changed the amount of time you spend in reducing (consolidating) data?

13. How has WIMS changed the availability of information that you need to do your job?

14. How has WIMS changed the speed at which you circulate information in your work?

Please use the following scale to answer question 15:

1	2	3	4	5	6	7
Large Failure	Moderate Failure	Small Failure	No Effect	Small Success	Moderate Success	Large Success

15. How has WIMS succeeded or failed? (You may amplify your response to this question on a separate piece of paper and enclose it with your computer score sheet)

Part III

You are asked to read the following statements (16 through 71) and to select the number that reflects most clearly how you feel about each statement. The key for your responses is as follows:

1	2	3	4	5
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

Please keep in mind that what is important is your own opinion. WIMS is a system that has just been introduced to the MAJCOMs, AFRCEs and Air Staff. It will be introduced to Air Force bases world-wide over the next four years. Your response to this questionnaire is important, BUT YOUR RESPONSE MUST REFLECT YOUR TRUE OPINION - PLEASE BE HONEST.

Each statement implies "since WIMS was implemented." Therefore, respond to each statement as it applies to the situation since WIMS became operational.

16. My job is more satisfying.
17. Others can better see the results of my efforts.
18. It is easier to perform my job well.
19. The accuracy of information I receive is improved by WIMS.
20. I have more control over my job.
21. I am able to improve my performance.
22. Others are more aware of what I am doing.
23. The information I receive from WIMS makes my job easier.
24. I spend less time looking for information.
25. I am able to see better the results of my efforts.
26. The accuracy of my work is improved as a result of using WIMS.
27. My performance is more closely monitored.
28. The division/directorate/section performs better.
29. I need to communicate with others more.
30. I need the help of others more.
31. I need to consult others more often before making a decision.
32. I need to talk with other people more.
33. The individuals I work with are changing.
34. The management structure is changing.
35. WIMS does NOT require any changes in division/directorate/ section structure.
36. I have had to get to know several new people.
37. Individuals set higher targets for performance.
38. The use of WIMS increases the Air Force's performance.
39. This project (WIMS) is technically sound.
40. Air Force goals are more clear.
41. My counterparts in other divisions/directorates/sections identify more with the Air Force's goals.
42. The patterns of communication are more simplified.
43. My goals and the Air Force's goals are more similiar.

1	2	3	4	5
Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

44. The aims of my counterparts in other divisions/directorates/ sections are more easily achieved.
45. My personal goals are better reconciled with the Air Force's goals.
46. Top management provides the resources to implement WIMS.
47. People accept the required changes.
48. Top management sees WIMS as being important.
49. Implementing WIMS is difficult.
50. Top management does not realize how complex this change is.
51. People are given sufficient training to utilize WIMS.
52. This project is important to top management.
53. There is adequate staff available to successfully implement WIMS.
54. My counterparts in other divisions/directorates/sections are generally resistant to changes of this type.
55. Personal conflicts have NOT increased as a result of WIMS.
56. The developers of WIMS provide adequate training to users.
57. The developers of WIMS do not understand management problems.
58. I enjoy working with those who are implementing WIMS.
59. When I talk to those implementing WIMS, they respect my opinions.
60. WIMS costs too much.
61. I am supported by my boss if I decide not to use WIMS.
62. Decisions based on WIMS are better.
63. The results of WIMS are needed now.
64. WIMS is important to me.
65. I need WIMS.
66. It was important that WIMS be used soon.
67. This project is important to my boss.
68. WIMS should have been put into use earlier.
69. It was urgent that WIMS be implemented.
70. The sooner WIMS was in use the better.
71. Benefits outweigh the costs.

Appendix B: Raw Data File

The following data consists of 262 cases. Each case consists of 71 consecutive answers on two lines of data, starting in column three. Answers shown here are one unit less than actual answers. Blanks represent missing values.

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Appendix C: First Iteration Communalities and Rotated Factor Matrix for User Attitudes

VARIABLE	COMMUNALITY	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6
V16	0.72412	0.76044	0.28945	-0.05137	0.10870	-0.02010	-0.07811
V17	0.66227	0.75120	0.17352	-0.09249	0.04662	0.09778	-0.03231
V18	0.74322	0.76486	0.24362	-0.03233	0.17373	0.04770	0.08957
V19	0.71281	0.69393	0.19403	0.04343	0.14258	0.01212	0.09361
V20	0.67982	0.74677	0.22254	0.02048	0.15326	0.12931	0.07186
V21	0.76547	0.82543	0.19142	0.01857	0.06611	0.10056	0.06041
V22	0.70571	0.77666	0.10382	0.03806	0.09558	0.00964	0.03392
V23	0.68010	0.68021	0.20589	0.01020	0.20052	0.03021	0.14496
V24	0.59209	0.63510	0.26881	-0.06953	0.15651	0.17102	0.10643
V25	0.74136	0.79975	0.20554	-0.01764	0.17127	0.01751	0.03425
V26	0.70437	0.78413	0.17468	0.02005	0.08189	-0.04625	0.02274
V27	0.56890	0.27664	-0.06348	0.22094	0.11383	0.02153	0.05237
V28	0.62805	0.64541	0.16907	-0.03494	0.09788	0.17130	0.13722
V29	0.47555	0.10951	0.18405	0.58388	0.04879	-0.06608	0.08442
V30	0.59462	-0.03339	-0.03140	0.72137	-0.09955	-0.09975	-0.06129
V31	0.58270	-0.03807	-0.06679	0.69339	0.14897	-0.01283	-0.05758
V32	0.82142	-0.05281	0.00364	0.88769	0.02084	-0.10325	-0.01773
V33	0.57640	0.20160	0.12872	0.16770	0.20511	0.00042	-0.00669
V34	0.65663	0.23636	0.08994	0.06637	0.11679	-0.00337	-0.01075
V35	0.17735	0.04432	-0.07519	0.02961	0.06211	0.05580	-0.00590
V36	0.30395	0.29306	0.18533	0.23859	0.18444	-0.00210	0.05885
V37	0.51521	0.48048	0.11101	0.15375	0.37729	-0.10768	0.02801
V38	0.67356	0.56199	0.33720	-0.03363	0.30137	-0.03951	0.08986
V39	0.39933	0.24209	0.29347	-0.07974	0.19255	0.13585	0.14280
V40	0.57427	0.41987	0.17425	0.07143	0.49693	0.12354	0.11516
V41	0.45880	0.28955	0.09669	-0.00158	0.55964	0.11325	0.06299
V42	0.50115	0.43835	0.16787	0.08087	0.30012	0.09062	0.06451
V43	0.62097	0.41805	0.09826	-0.01773	0.61346	0.08617	0.13989
V44	0.42118	0.26376	0.21422	0.04264	0.41867	0.03247	-0.05444
V45	0.60820	0.48901	0.14234	0.11128	0.54398	0.06725	0.05276
V46	0.32560	0.27780	-0.03408	-0.14147	0.08613	0.14956	0.23339
V47	0.46499	0.11359	-0.04704	0.04097	0.02008	0.29455	0.31193
V48	0.62735	0.02796	0.09910	-0.02211	0.03651	0.13308	0.73908
V49	0.36826	-0.18098	-0.05857	0.13093	-0.04443	-0.15312	0.13234
V50	0.48159	-0.11305	0.07687	0.06477	0.06606	-0.31495	-0.11943
V51	0.73206	0.10756	0.01530	-0.09906	0.04692	0.81001	-0.00811
V52	0.79294	0.19626	0.23629	-0.02707	0.13814	0.01784	0.79434
V53	0.29982	0.06354	-0.10577	-0.16067	0.02828	0.36643	0.10878
V54	0.33699	-0.02595	-0.13541	0.09418	0.02492	-0.07230	-0.10223
V55	0.43037	0.05242	0.06589	-0.04965	-0.01458	0.07561	0.15874
V56	0.72822	0.09689	0.11927	-0.10519	0.17573	0.75904	0.13888
V57	0.32893	-0.06800	-0.16830	-0.03242	-0.07495	-0.08721	-0.11279
V58	0.53980	0.18606	0.29800	0.01930	0.03821	0.02306	0.08362
V59	0.64254	0.10373	0.16112	-0.07984	-0.03309	0.10987	0.06460
V60	0.37160	-0.17460	-0.45059	0.09956	-0.06412	-0.17331	0.16514
V61	0.25267	0.07844	-0.33429	-0.01706	0.02597	-0.07395	-0.04507
V62	0.60652	0.51510	0.37047	0.07655	0.25249	0.02223	-0.03399
V63.	0.66217	0.24185	0.72203	0.08870	0.02440	-0.01507	0.14908
V64	0.78466	0.44799	0.71040	0.02456	0.02259	0.03694	0.04273
V65	0.71522	0.45461	0.67560	0.01972	0.04633	0.04636	0.07912
V66	0.74384	0.35512	0.72636	0.01972	0.03219	-0.02128	0.09015
V67	0.43015	0.26672	0.40753	-0.03144	0.12287	0.02664	0.33969
V68	0.70615	0.17301	0.76268	-0.00089	-0.00346	-0.05242	0.00991
V69	0.73581	0.24960	0.74804	0.08336	0.25620	-0.06181	0.08344
V70	0.89983	0.25147	0.84152	-0.00801	0.14803	-0.04546	0.07161
V71	0.71801	0.34765	0.71199	0.00254	0.20450	0.07398	0.10148

VARIABLE	FACTOR 7	FACTOR 8	FACTOR 9	FACTOR 10	FACTOR 11	FACTOR 12	FACTOR 13
V16	0.10652	-0.05462	0.09245	0.02368	-0.00404	0.13277	-0.00561
V17	0.05382	0.05234	0.03232	0.18029	-0.03201	0.05892	-0.05335
V18	0.10373	0.03189	0.09822	-0.02780	-0.14431	-0.08894	0.08000
V19	0.21806	0.01564	-0.01249	0.06790	0.24213	0.05733	-0.21915
V20	0.02133	0.04848	0.02591	-0.00280	-0.05269	-0.02531	0.14119
V21	0.03592	0.04381	0.04308	-0.08444	-0.10405	0.00398	0.07731
V22	-0.02275	0.09955	0.03614	0.24546	0.03868	0.08013	0.00096
V23	0.11722	0.19476	0.06448	-0.12983	-0.00922	-0.19279	0.05341
V24	0.04371	0.10259	0.10044	-0.05983	-0.02142	-0.12158	0.07227
V25	0.03158	0.11300	0.08526	-0.07001	0.01268	0.04747	-0.00525
V26	0.16547	0.06323	0.05348	0.04373	0.05886	0.06163	-0.07632
V27	0.02396	0.09697	0.08579	0.62284	0.04187	-0.07269	0.10519
V28	0.11072	-0.01122	0.03306	0.13395	0.26788	0.13200	0.05772
V29	-0.06273	0.02503	0.09045	-0.06532	0.05608	0.09801	-0.21244
V30	-0.08315	-0.03856	0.03229	0.07871	0.02512	-0.08717	0.15700
V31	-0.07731	-0.11146	0.10173	0.17544	0.02466	-0.09524	0.03332
V32	0.06584	0.04903	-0.01719	-0.00483	-0.08254	-0.02969	-0.06677
V33	-0.10004	-0.06446	0.64466	0.02696	0.00798	-0.13468	0.01676
V34	-0.08596	0.11801	0.72268	0.10253	0.01987	0.02980	-0.13829
V35	0.28510	0.06735	-0.17126	0.04499	0.14509	-0.14855	0.03943
V36	-0.05003	-0.10241	0.18016	-0.09294	0.17176	-0.04051	-0.06388
V37	-0.08119	0.04084	0.12556	0.08771	0.22946	0.09487	0.01699
V38	0.15988	0.03318	0.04016	-0.02098	0.28866	0.17278	0.02303
V39	0.13711	0.28392	0.07070	-0.20751	0.14157	0.05844	0.03727
V40	0.13324	0.00928	0.14670	-0.07246	0.17640	-0.07089	0.07936
V41	0.13950	-0.04009	0.10877	-0.01267	0.00213	-0.03250	-0.03871
V42	0.16162	-0.05239	0.08770	0.11056	0.20870	-0.19761	0.20115
V43	-0.11587	0.02118	0.02398	0.10319	-0.02840	-0.02310	-0.08039
V44	0.21346	0.02095	0.13771	0.12058	-0.00194	0.21158	0.01781
V45	-0.05879	0.07380	0.09915	0.01596	-0.04463	-0.10089	0.04510
V46	0.32342	-0.04772	0.10714	0.12755	0.02585	0.05201	0.07067
V47	0.18185	0.08219	-0.01563	0.01687	0.25978	0.31467	0.23849
V48	0.16228	0.06614	0.01421	0.07440	-0.08966	0.06433	0.04845
V49	-0.48170	-0.03937	0.12760	-0.00344	0.02670	-0.05968	-0.13357
V50	-0.55437	-0.05326	0.09922	0.03840	-0.07895	0.01026	-0.11430
V51	0.13815	0.02732	-0.04965	0.06336	0.05075	0.15169	-0.01287
V52	-0.10009	0.1[illegible]94	-0.02963	-0.07924	0.10437	0.06185	0.07071
V53	0.27037	0.05144	0.14595	-0.04801	-0.05355	-0.05529	0.08121
V54	-0.01893	-0.06411	0.05931	0.05372	-0.00084	-0.52950	-0.03965
V55	0.14719	0.26067	-0.15145	0.05085	0.00353	0.09284	0.51567
V56	0.23217	0.10677	-0.02227	0.00879	-0.02245	-0.02064	0.02078
V57	-0.44604	-0.16342	-0.02427	0.04762	0.07920	-0.10969	0.14890
V58	0.23828	0.58177	-0.00313	0.06574	0.03871	0.07625	0.01185
V59	0.05420	0.73923	0.03667	0.08186	-0.02756	0.02888	0.15186
V60	-0.04946	-0.15324	-0.01499	0.05332	-0.13758	-0.13436	0.02785
V61	0.04920	-0.12986	-0.10744	-0.27688	0.06845	0.05256	0.10663
V62	0.16791	-0.00887	0.08657	-0.04281	0.30098	-0.01328	-0.06570
V63	-0.01031	0.13106	0.07616	-0.03773	0.14103	-0.07070	0.04514
V64	-0.10916	0.19925	-0.00085	-0.04438	0.12614	-0.01002	-0.07350
V65	-0.07083	0.15796	-0.01784	-0.03655	0.09172	0.02159	-0.02591
V66	-0.09404	0.21725	-0.00313	-0.04194	0.12868	-0.03290	0.06847
V67	0.07039	0.01456	-0.02380	0.15795	0.13229	0.08448	-0.07366
V68	0.12723	-0.07574	0.08684	0.13868	-0.16008	0.11372	0.06648
V69	-0.01982	0.04202	0.05145	-0.02500	-0.13946	0.05212	-0.05458
V70	0.10166	-0.07360	0.09649	0.01793	-0.20172	0.11016	0.14510
V71	0.06248	0.05640	0.02043	-0.09758	0.09718	0.07081	-0.03377

Appendix D: Second Iteration Communalities and Rotated Factor Matrix for User Attitudes

VARIABLE	COMMUNALITY	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7
V16	0.70259	0.77211	0.30280	0.05341	-0.05371	0.02725	-0.07762	-0.04740
V17	0.61620	0.74284	0.17284	0.09144	-0.08503	0.04143	-0.05370	0.11967
V18	0.67548	0.75461	0.24275	0.08765	-0.04997	0.16291	0.05400	0.08642
V19	0.62759	0.72953	0.21656	0.15902	0.07101	-0.00160	0.09541	-0.09508
V20	0.63476	0.73694	0.21868	0.12590	0.00220	0.10703	0.07066	0.10752
V21	0.68980	0.79081	0.20239	0.08482	-0.02250	0.04484	0.03642	0.11146
V22	0.65831	0.78482	0.10205	0.00958	0.05418	0.05983	0.03720	0.15481
V23	0.59189	0.68076	0.22409	0.09572	-0.00793	0.17046	0.12677	0.15452
V24	0.54463	0.62052	0.26581	0.14319	-0.09308	0.18662	0.07866	0.13693
V25	0.72405	0.80335	0.23388	0.04964	-0.04340	0.10542	0.03672	0.08464
V26	0.69396	0.80462	0.19441	0.075[illegible]5	0.03824	-0.01775	0.00707	0.02508
V27	0.27581	0.31960	-0.09675	0.05744	0.29951	0.17823	0.04591	0.19347
V28	0.56422	0.67285	0.16579	0.23538	-0.00506	0.01358	0.16818	0.01018
V29	0.37502	0.11605	0.22040	-0.12037	0.53337	0.07091	0.07629	-0.05612
V30	0.55971	-0.02872	-0.05350	-0.16102	0.72357	-0.02041	-0.04755	0.06215
V31	0.58182	-0.01127	-0.08894	-0.08444	0.71226	0.22694	-0.04916	-0.07365
V32	0.70869	-0.04971	0.02619	-0.07771	0.83562	0.00724	-0.03425	-0.00190
V33	0.39062	0.22980	0.11861	-0.11737	0.16850	0.52700	-0.05827	0.02121
V34	0.32404	0.26175	0.11772	-0.09321	0.08902	0.45114	-0.05821	0.13470
V37	0.41520	0.53396	0.13101	-0.03231	0.16677	0.25580	0.09805	-0.09494
V38	0.60111	0.61948	0.36907	0.15992	-0.01120	0.08878	0.16581	-0.14168
V39	0.31302	0.25482	0.34438	0.24486	-0.09922	0.11688	0.17805	0.11969
V40	0.53072	0.48188	0.18892	0.24740	0.07618	0.39185	0.16096	-0.12789
V41	0.42175	0.34679	0.11860	0.22713	-0.00770	0.43840	0.09622	-0.18526
V42	0.38449	0.49333	0.13372	0.19856	0.11665	0.24460	0.09527	-0.03617
V43	0.49094	0.47040	0.11411	0.06873	-0.02113	0.45596	0.18147	-0.10319
V44	0.31462	0.33188	0.24793	0.23698	0.08174	0.25465	-0.00284	-0.12375
V45	0.54064	0.53683	0.15641	0.07044	0.10475	0.45026	0.09537	-0.01504
V46	0.25602	0.30025	-0.04182	0.33680	-0.10034	0.06054	0.19221	0.00364
V47	0.35016	0.12855	-0.02220	0.43201	0.06124	-0.09541	0.36213	0.05013
V48	0.48282	0.03414	0.09573	0.22168	-0.00380	0.02432	0.64039	0.11243
V49	0.32062	-0.19382	-0.07163	-0.47099	0.08968	0.16683	0.13960	0.02689
V50	0.43665	-0.11564	0.07041	-0.61001	0.02603	0.19609	-0.07764	-0.03243
V51	0.43215	0.07371	0.01267	0.62944	-0.13382	0.08095	0.01304	0.07570
V52	0.85019	0.20638	0.23594	-0.01352	-0.04708	0.06363	0.86018	0.07465
V53	0.26708	0.03746	-0.10831	0.44113	-0.17026	0.12695	0.04443	0.11078
V54	0.12294	-0.02419	-0.18729	-0.14685	0.09983	0.17651	-0.15626	0.01292
V55	0.22602	0.07015	0.06975	0.23690	-0.01845	-0.15776	0.21584	0.29714
V56	0.58937	0.07041	0.11207	0.69549	-0.13401	0.20379	0.11811	0.12130
V57	0.18541	-0.07594	-0.20758	-0.36084	-0.04379	0.03523	-0.05504	-0.01265
V58	0.39631	0.19817	0.34900	0.23378	0.04639	-0.02852	0.10229	0.40685
V59	0.52628	0.09517	0.21041	0.18978	-0.05329	0.01264	0.09032	0.65252
V60	0.32782	-0.17840	-0.48281	-0.18517	0.10472	-0.01605	0.12052	-0.05334
V61	0.15875	0.07362	-0.30409	0.01034	-0.04993	-0.13603	-0.00607	-0.19931
V62	0.54135	0.55643	0.33470	0.15471	0.09465	0.13533	0.00328	-0.14591
V63	0.62384	0.25650	0.70967	-0.03120	0.09695	0.05442	0.15860	0.12620
V64	0.73948	0.43984	0.71753	-0.04876	0.00833	0.02223	0.05969	0.15704
V65	0.69551	0.44862	0.65450	-0.00873	0.00560	0.01274	0.09820	0.12571
V66	0.71713	0.35934	0.72584	-0.07166	0.01439	0.01704	0.12604	0.19913
V67	0.37192	0.29786	0.39744	0.08626	-0.00844	0.03870	0.34087	-0.00667
V68	0.55118	0.18134	0.71925	0.02109	0.01952	0.00215	-0.00853	0.00878
V69	0.70816	0.25933	0.76407	-0.05578	0.05962	0.20184	0.09196	-0.03527
V70	0.74109	0.26513	0.80823	0.03439	-0.00644	0.10100	0.07166	-0.03149
V71	0.72080	0.36234	0.73755	0.12202	-0.01513	0.10246	0.13006	-0.05474

Appendix E: Final Communalities and Rotated Factor Matrix for User Attitudes

VARIABLE	COMMUNALITY	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7
V16	0.70964	0.75019	0.33917	0.14025	0.04578	-0.04593	-0.07382	-0.05001
V17	0.61441	0.73439	0.20687	0.09891	0.10272	-0.05957	-0.04148	0.08174
V18	0.67741	0.72770	0.26313	0.25184	0.06841	-0.05308	0.07308	0.04866
V19	0.61059	0.70473	0.23877	0.12488	0.15529	0.06480	0.11213	-0.02120
V20	0.61601	0.69837	0.23925	0.20426	0.12168	-0.01500	0.10830	0.05063
V21	0.68886	0.77198	0.24319	0.13460	0.09206	-0.00435	0.03767	0.07578
V22	0.65298	0.76903	0.13366	0.13597	0.02256	0.07901	0.03554	0.13119
V23	0.59472	0.64366	0.23991	0.25966	0.07564	-0.01480	0.13896	0.17374
V24	0.53665	0.58549	0.28804	0.24529	0.14040	-0.08629	0.09301	0.12211
V25	0.72552	0.76866	0.26622	0.21310	0.04874	-0.02580	0.02283	0.12178
V26	0.70023	0.79318	0.22822	0.08846	0.08068	0.04967	0.01298	0.04521
V27	0.25048	0.32251	-0.09101	0.17286	0.06587	0.30055	0.05219	0.10442
V28	0.56827	0.64993	0.19078	0.12249	0.24722	-0.00785	0.18229	-0.00702
V29	0.38397	0.09660	0.21806	0.08884	-0.12446	0.54743	0.06278	0.00950
V30	0.55327	-0.02478	-0.04452	-0.03348	-0.15482	0.72384	-0.03977	0.00764
V31	0.59342	-0.03165	-0.08214	0.21202	-0.07571	0.72366	-0.06115	-0.08724
V32	0.71130	-0.05083	0.03067	0.01692	-0.09256	0.83415	-0.05153	0.02123
V33	0.33544	0.17216	0.11063	0.48955	-0.13860	0.17814	-0.04326	0.03299
V34	0.27622	0.22160	0.07666	0.42541	-0.12567	0.07070	-0.00535	0.13943
V37	0.42261	0.47315	0.14281	0.38055	-0.05048	0.16433	0.06136	-0.01452
V38	0.56868	0.56054	0.38792	0.25258	0.13556	-0.02154	0.14164	-0.03602
V39	0.33521	0.21098	0.35543	0.18342	0.23127	-0.08752	0.13391	0.22726
V40	0.53508	0.39657	0.20216	0.51334	0.22507	0.05927	0.13387	-0.03657
V41	0.42881	0.26278	0.12350	0.54066	0.19917	-0.01946	0.06475	-0.08915
V42	0.38921	0.44361	0.15432	0.32937	0.19311	0.10121	0.10159	-0.04771
V43	0.48675	0.39525	0.12458	0.53968	0.05975	-0.01629	0.13973	-0.01988
V44	0.31806	0.27896	0.25763	0.34889	0.20786	0.07545	-0.03802	-0.04245
V45	0.55464	0.45338	0.16192	0.55102	0.04838	0.08825	0.08431	0.04483
V46	0.26875	0.28834	-0.04365	0.10811	0.31613	-0.12824	0.23290	-0.03733
V47	0.32997	0.12417	0.00292	-0.02955	0.45464	0.07806	0.30885	0.07411
V48	0.52748	0.02414	0.07912	0.01801	0.22360	-0.01870	0.68348	0.05317
V49	0.30351	-0.21077	-0.10399	0.09815	-0.45232	0.09096	0.15909	0.02135
V50	0.42455	-0.14312	0.02166	0.16829	-0.61043	0.00587	-0.04487	-0.02458
V51	0.45272	0.05950	0.01986	0.07981	0.65118	-0.12134	0.02128	0.05657
V52	0.83575	0.16196	0.22654	0.10634	0.00801	-0.05476	0.85803	0.08725
V53	0.25763	0.02228	-0.10737	0.10817	0.42430	-0.18083	0.07681	0.07262
V56	0.60806	0.03728	0.12996	0.19840	0.71259	-0.11812	0.11379	0.12546
V58	0.43080	0.19580	0.33677	0.00246	0.19835	0.04971	0.08396	0.47976
V59	0.73949	0.09636	0.18228	0.00258	0.16334	-0.03621	0.05272	0.81621
V60	0.35163	-0.16025	-0.49626	-0.05691	-0.17745	0.08297	0.15944	-0.11242
V62	0.52111	0.50999	0.40816	0.25549	0.14034	0.08849	0.00063	-0.04042
V63	0.63022	0.22414	0.71689	0.08446	-0.04092	0.10805	0.16134	0.13976
V64	0.73782	0.41396	0.72041	0.07061	-0.06078	0.01666	0.07908	0.17960
V65	0.69442	0.42381	0.69019	0.06868	-0.01602	0.01514	0.11213	0.14374
V66	0.72003	0.32677	0.73131	0.06567	-0.08315	0.02410	0.13087	0.22251
V67	0.37099	0.26534	0.35915	0.10369	0.05576	-0.05496	0.39020	-0.04960
V68	0.56342	0.15983	0.73180	0.01872	0.00938	0.03120	0.01093	-0.02849
V69	0.71664	0.19787	0.76862	0.25927	-0.08537	0.06320	0.08692	0.02546
V70	0.76439	0.21769	0.82939	0.15386	0.01521	0.00021	0.07356	-0.03812
V71	0.72266	0.30912	0.75380	0.18549	0.10339	-0.01015	0.11685	0.00690

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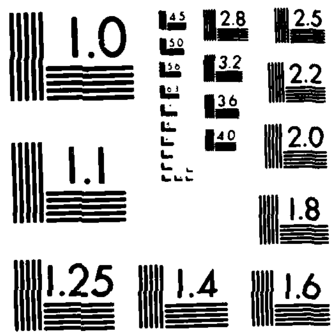

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Bibliography

1. Ackoff, Russell. "Management Misinformation Systems," Management Science, 14(4): 147-156 (December 1967).

2. Air Force Engineering and Services Center. Specifications for the Engineering and Services Information Management System, Section C. Tyndall AFB FL, 17 November 1983.

3. Air Force Engineering and Services Center. Engineering and Services Data Automation Game Plan. Letter. Tyndall AFB FL, 7 March 1983.

4. Air Force Engineering and Services Center. Minutes of Engineering and Services Automated Data Processing (ADP) Planning Meeting. Tyndall AFB FL, 16-17 September 1982.

5. Allport, Gordon W. "Attitudes," Readings in Attitude Theory and Measurement, edited by M. Fishbein. New York: John Wiley and Sons, 1967.

6. Anderson, J., G. Dickson, and J. Simmons. "Behavioral Reactions to the Introduction of a Management Information System at the U.S. Post Office: Some Empirical Observations," Computers and Management, edited by D. H. Sanders. New York: McGraw-Hill Book Company, 1980.

7. Anthony, Robert N. Planning and Control Systems: A Framework for Analysis. Cambridge MA: Harvard University, Graduate School of Business Studies, 1965.

8. Anthony, Robert N. and Regina E. Herzlinger. Management Control in Nonprofit Organizations. Homewood IL: Richard D. Irwin, Inc., 1980.

9. Birks, Evan G. "The Computer in a Management Information System," The Impact of Information Technology on Management Operations, edited by William C. House. New York: Auerbach Publishers, 1971.

10. Bispo, James L. "Information Processing--Visions of the Future," Signal, 36: 13-14 (February 1982).

11. Bjorn-Anderson, Niels and Leif Bloch Rasmussen. "Sociological Implications of Computer Systems," Human Interactions with Computers, edited by H. T. Smith and T. R. G. Green. London: Academic Press, 1980.

12. Bohrnstedt, George. "Reliability and Validity Assessment in Attitude Measurement," Attitude Measurement, edited by Gene F. Summers. Chicago: Rand McNally and Company, 1970.

13. Bromilow F. and R. Culvenor. "Building Terotechnology in Australia--An Overview," Transactions of the Institution of Engineers, Australia, Civil Engineering, 24(1): 34-39 (1982).

14. Cerullo, Michael J. "Information Systems Success Factors," Journal of Systems Management, 31(12): 10-19 (December 1980).

15. Cheney, Paul H. and Gary W. Dickson. "Organizational Characteristics and Information Systems: An Exploratory Investigation," Academy of Management Journal, 25(1): 170-184 (March 1982).

16. Clayton, Captain Carl, AFESC/AD. Telephone interview. 21 February 1984.

17. Comrey, A. L. A First Course in Factor Analysis. New York: Academy Press, 1973.

18. DeGroff, William. "The Information System Evaluation: An Emerging Management Responsibility," Government Finance, 10(3): 3-9 (September 1981).

19. Department of the Air Force. Headquarters AFRES Organization and Functions. AFRESR 23-44. Robins AFB GA: HQ AFRES, 7 December 1983.

20. Department of the Air Force. Work Information Management System (WIMS-MAJCOM System). Projected Automation Requirement HAF-F81-1. Tyndall AFB FL: AFESC, 21 November 1983.

21. Department of the Air Force. Engineering and Services Draft Master Plan. Tyndall AFB FL: AFESC, 14 September 1983.

22. Department of the Air Force. Work Information Management System. Information Resource Requirement Document. Tyndall AFB FL: AFESC, 2 September 1983.

23. Department of the Air Force. MAJCOM Engineering and Services Organization and Functions. AFR 85-7. Washington: HQ USAF, 10 May 1983.

24. Department of the Air Force. Engineering and Services Strategic Plan. Washington: HQ USAF, May 1983.

25. Department of the Air Force. Civil Engineering Red Horse Squadrons. AFR 93-9. Washington: HQ USAF, 15 April 1983.

26. Department of the Air Force. Manpower: Organization Policy and Guidance. AFR 26-2. Washington: HQ USAF, 6 January 1982.

27. Department of the Air Force. Organization and Mission Field: Air Force Engineering and Services Center (AFESC). AFR 23-40. Washington: HQ USAF, 18 August 1981.

28. Department of the Air Force. Engineering and Services Information Requirements Study Report, Base Level and Vertical Requirements, Volume 1. Tyndall AFB FL: HQ AFESC, August 1981.

29. Department of the Air Force. Air Force Civil Engineering Job Order Management Information System --Demonstration Project. Data Automation Requirement 85-2. Tyndall AFB FL: HQ AFESC, 5 March 1981.

30. Department of the Air Force. Engineered Performance Standards for Real Property Maintenance Activities -- Planner and Estimator's Workbook. AFM 85-58. Norfolk VA: Naval Facilities Engineering Command, March 1980.

31. Department of the Air Force. Operation and Maintenance of Real Property. AFR 85-10. Washington: HQ USAF, 24 October 1975.

32. Department of the Air Force. Air Force Regional Civil Engineers. AFR 88-18. Washington: HQ USAF, 16 March 1970.

33. Department of the Air Force. Work Information Management System. Data Automation Requirement. Tyndall AFB FL: AFESC, undated.

34. Drucker, Peter F. The Effective Executive. New York: Harper and Row, 1966.

35. Ein-Dor, Phillip and Eli Segev. "Organizational Context and the Success of Management Information Systems," Management Science, 24(10): 1064-1077 (June 1978).

36. Emory, C. William. Business Research Methods. Homewood IL: Richard D. Irwin, Inc., 1980.

37. Federico, Pat-Anthony, Kim Brun, and Douglas McCalla. Management Information Systems and Organizational Behavior. New York: Praeger Publishers, 1980.

38. Fishbein, Martin. "Attitude and the Prediction of Behavior," Readings in Attitude Theory and Measurement, edited by M. Fishbein. New York: John Wiley and Sons, 1967.

39. Gardner, Paul Leslie. "Scales and Statistics," Review of Education Research, 45: 43-57 (Winter 1975).

40. Ginzberg, Michael J. "A Study of the Implementation Process," The Implementation of Management Science, edited by R. Doktor, R. L. Schultz and D. P. Slevin. New York: North-Holland Publishing Company, 1979.

41. Ginzberg, Michael J. "Finding an Adequate Measure of OR/MS Effectiveness," Interfaces, 8(4): 59-62 (1978).

42. Ginzberg, Michael J. A Detailed Look at Implementation Research. Report CSIR-4. Massachusetts Institute of Technology, Center for Information Systems Research, 1974.

43. Green, Gary and Robert T. Keim. "After Implementation What's Next? Evaluation," Journal of Systems Management, 34(9): 10-15 (September 1983).

44. Gremillion, Lee L. Managing MIS Implementation. Ann Arbor MI: UMI Research Press, 1982.

45. Hair, J. F. Jr., et al. Multivariate Data Analysis. Tulsa OK: Petroleum Publishing Company, 1979.

46. Harrison, Frank E. Management and Organizations. Boston: Houghton Mifflin Company, 1978.

47. Headquarters United States Air Force. Interim Message Change 83-2 to AFR 85-10, 24 Oct 75. Message distributed by LEE. Bolling AFB DC, 5 December 1983.

48. Headquarters United States Air Force. AR7115 Report by LEE. Washington, 30 September 1983.

49. Headquarters United States Air Force. Engineering and Services Automation. Letter. Washington, 21 March 1983.

50. Hull, C. Hadlai and Norman H. Nie. SPSS Update 7-9. New York: McGraw-Hill Book Company, 1981.

51. Ives, Blake, Scott Hamilton, and Gordon B. Davis. "A Framework for Research in Computer-Based Management Information Systems," Management Science, 26(9): 910-934 (September 1980).

52. Junkin, Major. Telephone interview. HQ USAF/LEEP, Washington DC, 3 April 1984.

53. Katzan, Harry Jr. Information Technology: The Human Use of Computers. New York: Mason and Lipscomb Publishers, Inc., 1974.

54. Keen, Peter G. W. Implementation Research in OR/MS and MIS: Description versus Prescription. Working Paper No 390. Graduate School of Business, Stanford University, 1977.

55. Keen, Peter G., and Michael S. Scott Morton. Decision Support Systems: An Organizational Perspective. Reading MA: Addison-Wesley Publishing Company, 1978.

56. Kim, Jae-On and Charles W. Mueller. Introduction to Factor Analysis. Beverly Hills CA: Sage Publications, 1978.

57. Leavitt, H. J. and T. L. Whisler. "Management in the 1980's," Harvard Business Review, 36(6): 41-48 (1958).

58. Lucas, Henry C. Jr. "The Implementation of an Operations Research Model in the Brokerage Industry," The Implementation of Management Science, edited by R. Doktor, R. L. Schultz and D. P. Slevin. New York: North-Holland Publishing Company, 1979.

59. Lucas, Henry C. Jr. "Empirical Evidence for a Descriptive Model of Implementation," MIS Quarterly, 2(2): 27-52 (1978).

60. Lucas, Henry C. Jr. The Implementation of Computer Based Models. New York: National Association of Accountants, 1976.

61. Lucas, Henry C. Jr. Why Information Systems Fail. New York: Columbia University Press, 1975.

62. Lucas, Henry C. Jr. Systems Quality, User Reactions, and the Use of Information Systems. Research Paper Series, Research Paper No 193. Graduate School of Business, Stanford University, January 1974.

63. Mason, Richard O. and Ian I. Mitroff. "A Program for Research on Management Information Systems," Management Science, 19(5): 475-487 (January 1973).

64. McLean, E. R. A Computer-Based Medical History System: Factors Affecting its Acceptance and Use by Physicians. Unpublished PhD dissertation. Massachusetts Institute of Technology, 1970.

65. Mumford, E. and O. Banks. The Computer and the Clerk. London: Routledge and Kegan, 1967.

66. Nie, Norman H. et al. SPSS: Statistical Package for the Social Sciences (Second Edition). New York: McGraw-Hill Book Company, 1975.

67. Nunnally, Jum C. Psychometric Theory. New York: McGraw-Hill Book Company, 1967.

68. Office of Management and Budget. The United States Budget in Brief -- Fiscal Year 1984. Serial Number 041-001-00265-1. Washington: Government Printing Office, 1983.

69. Robey, D. "User Attitudes and Management Information System Use," Academy of Management Journal, 22(3): 527-38 (1979).

70. Robey, D. and M. M. Bakr. "Task Redesign: Individual Moderating and Novelty Effects," Human Relations, 38(8): 689-701 (1978).

71. Robey, D. and R. F. Zeller. "Factors Affecting the Success and Failure of an Information System for Product Quality," Interfaces, 8(2): 70-78 (1978).

72. Rockart, J. F. "The Changing Role of the Information Systems Executive: A Critical Success Factors Perspective," Sloan Management Review, 24: 3-13 (Fall 1982).

73. Rodriguez, J. The Design and Evaluation of a Strategic Issue Competitive Information System. PhD dissertation, University of Pittsburgh, 1977.

74. Rosenberg, Milton J. and Carl I. Hovland. Cognitive, Affective and Behavioral Components of Attitudes," Attitude Organization and Change: An Analysis of Consistency Among Attitude Components, edited by Milton J. Rosenberg et al. New Haven CT: Yale University Press, 1960.

75. Schewe, C. D. "The Management Information System User: An Exploratory Behavioral Analysis," Academy of Management Journal, 19: 577-590 (1976).

76. Schultz, R. L. and D. P. Slevin. "Implementation and Organizational Validity: An Empirical Investigation," Implementing Operations Research/Management Science, edited by R. L. Schultz and D. P. Slevin. New York: American Elsevier, 1975.

77. Shaw, Marvin E. and Jack M. Wright. Scales for the Measurement of Attitudes. New York: McGraw-Hill Book Company, 1967.

78. Stone, Eugene. Research Methods in Organizational Behavior. Santa Monica CA: Goodyear Publishing Company, 1978.

79. Stopher, Peter and Armin H. Meyburg. Survey Sampling and Multivariate Analysis for Social Scientists and Engineers. Lexington MA: Lexington Books, 1979.

80. Summy, J. H. An Exploratory Study of Freshman and Sophomore Business Students' Attitudes Toward Selected Academic Majors in Business. Unpublished PhD dissertation. Arizona State University, 1974.

81. Swanson, E. B. "Management Information Systems: Appreciation and Involvement," Management Science, 21(2): 178-188 (1974).

82. Tabachnick, Barbara G. and Linda S. Fidell. Using Multivariate Statistics. New York: Harper and Row, 1983.

83. Triandis, Harry C. Attitude and Attitude Change. New York: John Wiley and Sons, Inc., 1971.

84. Voich, Dan Jr., Homer J. Mottice, and William Shrode. Information Systems for Operations and Management. Cincinnati OH: South-Western Publishing Company, 1975.

85. Zmud, Robert. "Individual Differences and MIS Success: A Review of the Empirical Literature," Management Science, 25(10): 966-979 (October 1979).

VITA

Squadron Leader Kenneth W. Moschner was born on 19 August 1954 in Sydney, New South Wales, Australia. He graduated from high school in Northmead, New South Wales, in 1972 and attended the University of Western Australia from which he received the degree of Bachelor of Civil Engineering in December 1976. Upon graduation, he was employed as a civil engineer for the Groundwater Division of the Metropolitan Water, Sewage and Drainage Board, Perth, Western Australia. In May 1977, he received a commission in the Royal Australian Air Force (RAAF) through the Direct Entry program. He first served at RAAF Base Darwin, Northern Territory, Australia as a works liaison officer until January 1979. Next, he worked for one year as a design and construction engineer for the Royal Australian Army at 22 Construction Squadron, Perth, Western Australia. He then served 3 1/2 years at Headquarters Support Command (RAAF), Melbourne, Victoria, Australia in facilities management and technology, until entering the Graduate Engineering Management program at the School of Systems and Logistics, Air Force Institute of Technology, in June 1983.

Permanent address:

Department of Defence (Air Force Office)
Russell Offices (C-3-10)
Canberra, Australian Capital Territory 2600

VITA

Captain Frederick W. Nightengale was born on 28 September 1953 in Indianapolis, Indiana. He graduated from Central High School in LaCrosse, Wisconsin in 1971 and attended the University of Wisconsin-LaCrosse for one year. In September 1972, he enlisted in the Air Force and was trained as a Communications Center Specialist. In May 1974, he was awarded an AFROTC scholorship and attended Brigham Young University in Provo, Utah from which he received a degree of Bachelor of Science in Civil Engineering in December 1977. Upon graduation, he was commissioned as a Second Lieutenant in the USAF. He was assigned to the 435 Civil Engineering Squadron at Rhein-Main Air Base, Germany, from January 1978 to January 1981. He was then assigned to the 820 Civil Engineering Squadron (RED HORSE) at Nellis AFB, Nevada from January 1981 to November 1981. In November 1981 he was assigned to the 554 Civil Engineering Support Squadron at Nellis AFB, Nevada, where he served until entering the Graduate Engineering Management program at the School of Systems and Logistics, Air Force Institute of Technology, in June 1983.

Permanent Address:

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Mauston, Wisconsin 53948

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The Work Information Management System (WIMS) is a $95 million project to improve operational and management control at Engineering and Services organizations of the USAF. Early implementation of part of this project at installations in the U.S. and Europe provided the opportunity to study its implementation success. This study is concerned with the factors that promote and jeopardize the success of WIMS. It determines the relationship between user attitudes and WIMS success, and explores how they are affected by the user's location, age, education, and prior computer experience. Using a mailed questionnaire to collect data from 400 respondents in the implementing organizations, and using factor analysis and regression analysis to analyze the data, the researchers found several significant relationships. Positive relationships were found between WIMS success and the user's attitudes about how WIMS improves job performance and how urgent WIMS was. Education of users was found to positively affect one's attitude about sense of urgency but to negatively affect WIMS success and one's attitude about job performance. Age of users was found to negatively affect WIMS success and one's attitudes about job performance and sense of urgency. Persons with prior computer experience were found to report higher levels of success with WIMS and demonstrated more positive attitudes. Finally, of the 19 locations studied, only one, Space Command, reflected a higher level of success, and only one, Tactical Air Command, displayed better attitudes about how WIMS affects job performance. The significance of these findings reflects the importance for implementation efforts to foster positive attitudes about how WIMS can improve individual job performance and about how urgent it is for WIMS to be implemented. Moreover, implementation strategies should acknowledge the effects of how attitudes and WIMS success are affected by location, age, education, and prior computer experience of users.

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